The Electrical Industry's Weekly Magazine

November 17, 1958

Electrical World

Price 50 Cents

A McGraw-Hill Publication

NEMA GEARS UP FOR '59

Report on 32nd Annual Meeting National Electrical Manufacturers Association

page 69

POWER SALESMEN!

See 4-page Industrial Section . . . . p 81

STEVENS RICE
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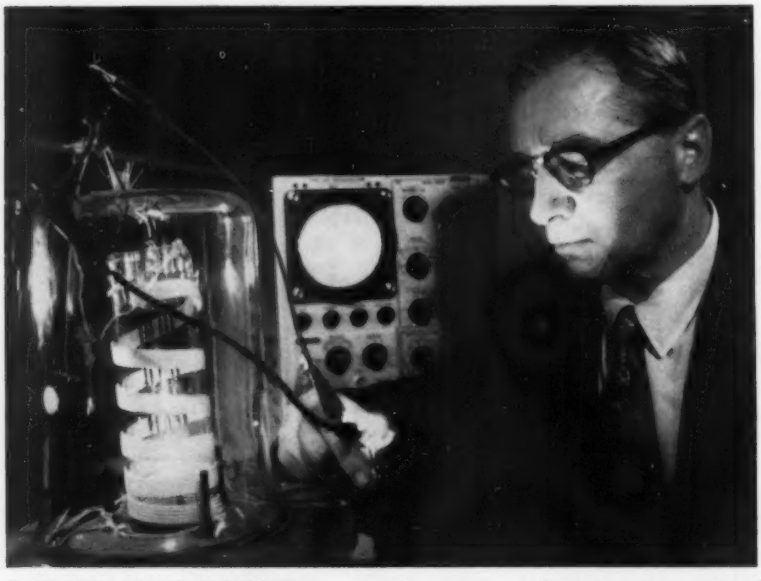
TODAY'S RESEARCH AND TOMORROW'S POWER



G.E.'S THERMIONIC CONVERTER, as a major power producer is a long way off. Pure research, however, is paying off in new ideas for improving today's generating equipment. Immediate gains are being achieved through research and development on . . .

TECHNOLOGICAL PROGRESS

General Electric's "across the board" approach to scientific research in the development of new sources of energy for generating electricity is expected to yield immediate as well as long-term improvements in power generation equipment.

TWO LONG-TERM PROSPECTS for generating electricity which appear technically and economically feasible in the years that lie ahead are—fission power and fusion power.

In addition to continued technological progress in these areas, intensive research is also being carried on to develop and utilize even more novel sources of energy—the fuel cell, direct conversion of solar energy to electricity, and the thermionic converter.

Investigations in these and other areas will undoubtedly produce unexpected payoffs which can have almost immediate application. The search for fusion power, for example, could lead to by-products in circuit technology or radiation generation long before fusion energy is harnessed for peaceful use.

SIGNIFICANT PROGRESS has already been achieved in the liquid cooling of generator stators. The nation's first large turbine-generator with water-cooled stator windings is now being manufactured by General Electric. The two generators of this cross-compound unit are each rated 265,000-kva at 30 psig hydrogen pressure.

. . . longer last-stage buckets

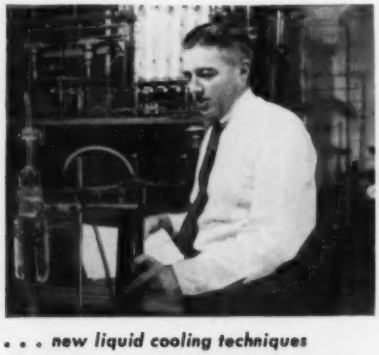
Water has over twice the heat removal ability of oil. Its use as a liquid coolant will help to open up avenues for: 1) the building of generators of up to one million kva capacity while retaining the basic design simplicity of conventionally-cooled units, 2) significant savings in power plant construction costs, and 3) overcoming the limitations on higher generator ratings imposed by current shipping restrictions.

BENEFITS TO ELECTRIC UTILITIES—By searching for new knowledge and capitalizing on existing technological opportunities, General Electric is striving for turbine-generator advances that will continue to result in low operating costs per kilowatt-hour of electricity produced. Exploring all possible avenues for technical innovations and product improvements also helps electric utilities to satisfy their needs for increased power capacity. Also, these General Electric research programs mean added value-in-use for G-E steam turbine-generators operated by electric utilities.

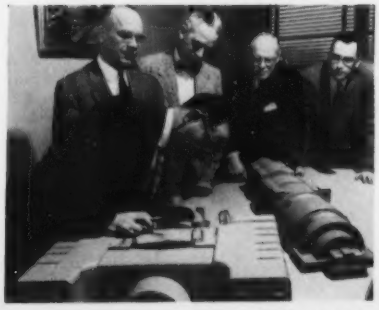
FOR MORE INFORMATION on today's research and tomorrow's power at General Electric, contact your local G-E Apparatus Sales Office or write for Bulletin GP-81. General Electric Company, Section 301-388, Schenectady 5, N. Y.

MORE POWER TO AMERICA

GENERAL ELECTRIC



. . . new liquid cooling techniques



. . . and increasing the capacity of steam turbine-generators.

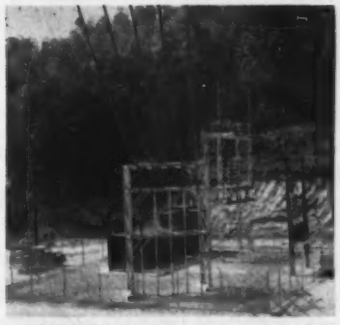
Electrical World

Vol. 150, No. 20 NOVEMBER 17, 1958

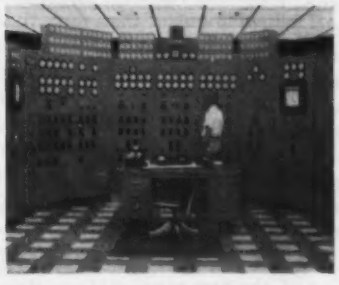
Published for 84 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue

p 69



p 76



p 79

CURRENT EVENTS

NEMA Gears Up for 1959

Manufacturers hear Mitchell tell of opportunities. New officers are elected at annual Atlantic City meeting.....p 69

GENERATION

Nuclear Plant Estimating Is Difficult

Fuel cycle is more complicated than for conventional plants. Government holds title to nuclear fuel.....p 72

INDUSTRIAL

Reliability High for Automated Coal Plant

Ward J. Heacock, Link-Belt Co

Preassembled aerial cable circuits carry 6.9-kv primary from sub to main building. Pole lines are also used.....p 76

RELAYING & PROTECTION

Update Relaying for Transmission Gains

M. F. Hebb, Florida Power Corp, J. T. Logan, consulting engineer

Planned relay modernization programs increase transmission system capability, save in three ways.....p 79

SALES

Industrial Applications

Special 4-page section offers eight case histories of successful power uses in industry.....p 81

Departments

Editorials 65
• Electrical Week 19
Engineering Reference Sheet 88
Executive Reader 22
From the Publisher 5
How To 94
• Management Newletter ...129
Manufacturers News 98
New Equipment 104
Manufacturers Literature ..126
News About People 137
Readers Forum 148
Readers Service 120
Selling 122
INDEX TO ADVERTISERS ...152

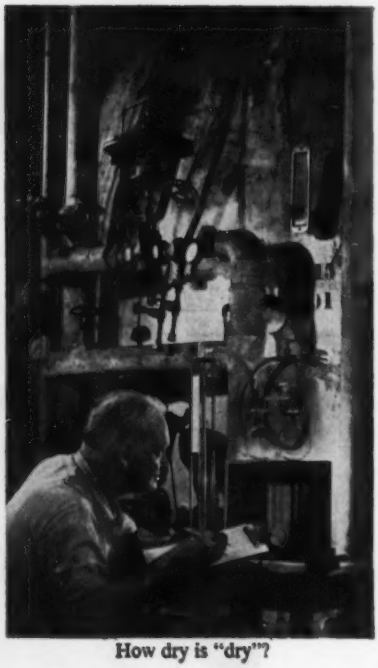
ADVERTISEMENT

The "EVP" Test Contributes to the Efficiency and Reliability of Paper Cables

The efficiency and reliability of a paper cable is dependent to a large extent upon how thoroughly the paper insulation has been oil-impregnated. Oil-inhibiting "wet spots" should be completely eliminated and the overall moisture content of the insulation brought down to a predetermined minimum. Only then is the cable ready for impregnation. For maximum assurance, the cable should be moisture-tested to determine when the optimum amount of moisture has been taken out of the insulation.

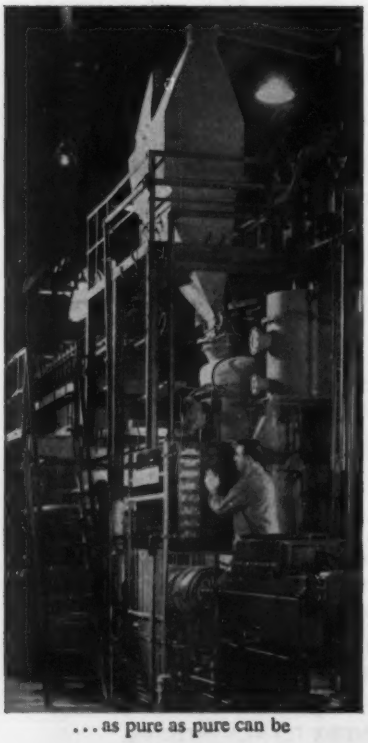
V. L. Garrison
Plant Manager

A power factor or capacitance test is used by most manufacturers to determine when the cable has been dried long enough. This is a simple expedient but has the disadvantage of being inaccurate after the bulk of the moisture has been extracted from the insulation. The only way to be absolutely sure the cable has been adequately dried is to measure the moisture itself. For this purpose, Okonite Research adopted the Equilibrium Vapor Pressure Test ("EVP" for short). This unique test indicates precisely when a paper cable is ready to be oil-impregnated.



How dry is "dry"?

A "Junior Refinery" Assures Low Power Factor in Okonite Paper Insulation



. . . as pure as pure can be

Impregnating paper insulation with electrically-unqualified, impure oil can cause a cable to be inefficient . . . to have a high power factor. For this reason, even the highest quality impregnating oils must be "refined" to bring them up to the strict Okonite requirements. At Okonite, all oil submitted by our suppliers is first checked for its electrical properties and then processed through our "junior refinery" for purification. This involves treating the oil with a cleansing agent, degasifying it, and subjecting it to several filterings. Throughout the purification cycle the oil does not come in contact with the air. This prevents contamination.

1. A test for directly determining the dryness of paper insulation before it is impregnated with oil, and

2. a "junior refinery" to insure that only fully qualified oil is used . . .

. . . two concrete examples of the effort that Okonite exerts to insure that the paper cables we make for you are the best it is possible to produce. This is all evidence to the fact that Okonite paper cables contain *added values*, values that are not written into specifications.

Today, every good engineer I know is looking for ways to get the maximum value out of the money he invests for his company or client. The *added values* in Okonite paper cables provide an opportunity to get extra life and dependability out of electrical cable systems. As one engineer to another, I urge you to become better acquainted with the long range economy of Okonite paper cables.

If you have not received your copy of the new paper cable catalog, or if I can be of help to you with a current problem, please get in touch with me at The Okonite Company, Passaic, N. J.

6039

***where there's electrical power . . . there's* OKONITE CABLE**

A Proven Product—A Better Package

Many of you have been wondering why the Selling page devoted to industrial applications has been missing from the past few issues of Electrical World. Its absence was entirely intentional.

Starting with this issue the department will appear regularly in a new dress; like the four-page, two-color section following page 113.

To many of our power sales readers, the format of this week's section is as familiar as an old friend's face. Under its title, "Industrial Applications," it has long been one of the industry's most useful power sales promotion tools.

About eight years ago the industrial power sales manager for a large electric company suggested that we reprint our industrial sales pages periodically so that power sales staffs could use them in direct mail programs. He wanted to show his industrial customers how industry elsewhere was modernizing, electrically. The idea caught on.

Today more than 26,000 industrial customers regularly receive Electrical World's Industrial Applications reprint in the form that it appears here. We feel that our readers, too, will find this treatment of the industrial material formerly appearing in our weekly Selling section not only attractive, but interesting and useful as well.

Fischer Black

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ELECTRICAL WORLD

Vol. 150, No. 20, Nov. 17, 1958

Published weekly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948), Founder. Executive, Editorial, Circulation and Advertising Offices: McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Printed at 99-129 North Broadway, Albany 1, N. Y. See panel at right for information regarding subscriptions or change of address.

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United States and Canada subscription rate for individuals in the field of the publication $6.00 per year; single copies 50 cents. Other Western Hemisphere and the Philippines $20.00 payable in advance and other countries $30.00 payable in advance.

Second-class postage paid at Albany N. Y. Title registered in U. S. Patent Office.

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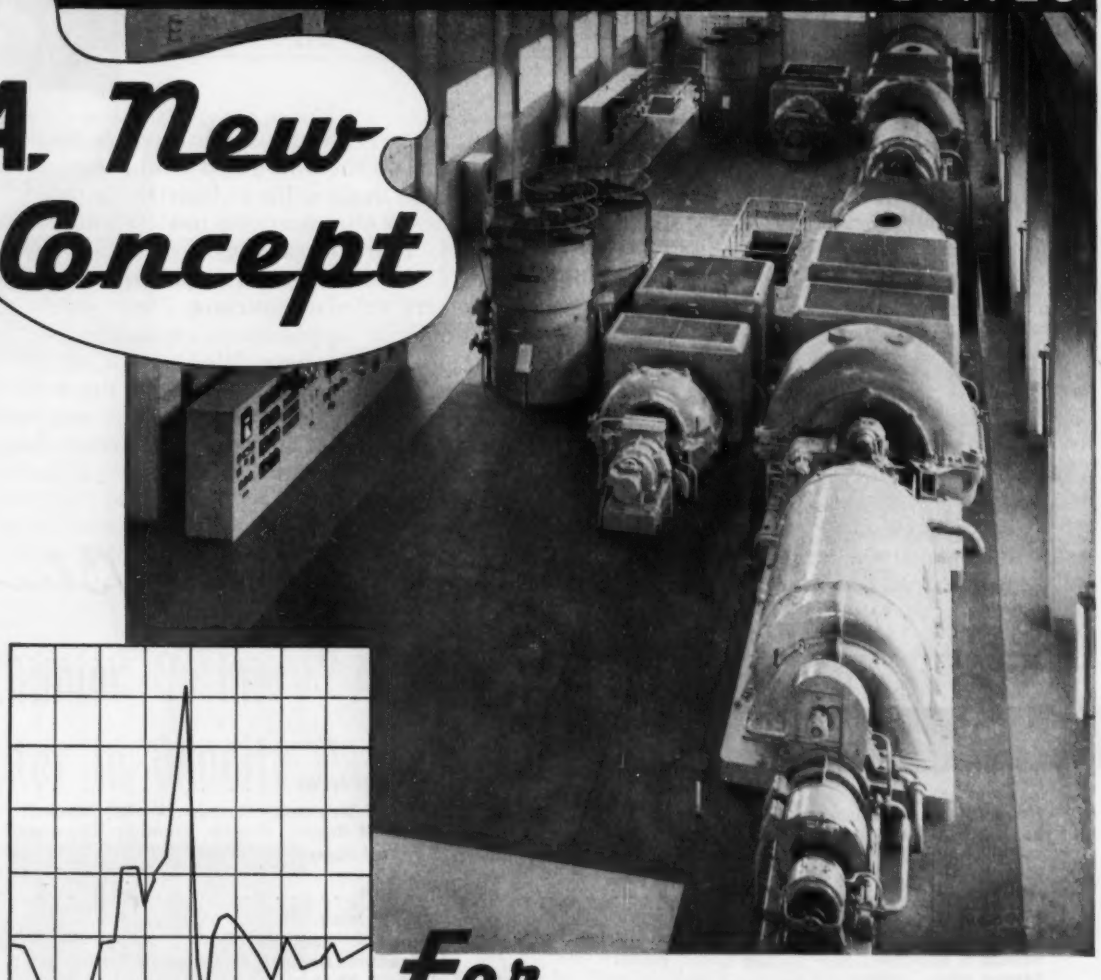
BROWN BOVERI GAS TURBINES

A New Concept



For Peak Loads

DEPENDING on the load, either the 7,000 kW single shaft or the 25,000 kW non-regenerative cycle Brown Boveri Gas Turbine provide the answer to the rigid demands of peak load service. *They can be put on the line in 20 minutes or less.*

Their on-the-job performance records—in over 60 power plants throughout the world—conclusively indicate not only economy of operation but sizeable savings in initial costs.

If your problem is *peak* or *base* load service, it will pay you to investigate Brown Boveri Gas Turbines. Visit Our Booth #556 at the Power Show N. Y. Coliseum, Dec. 1-5, 1958

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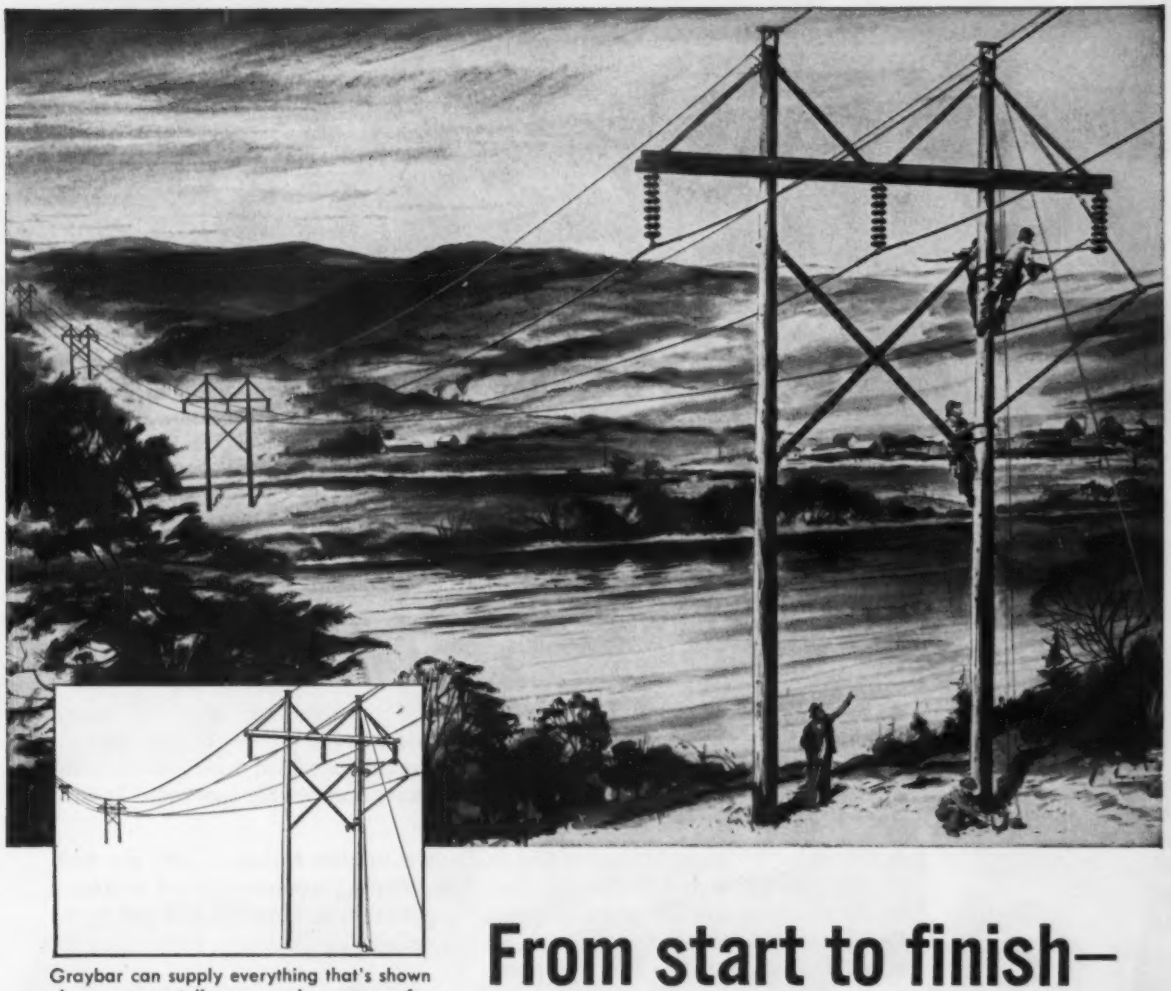


Graybar can supply everything that's shown above — except linemen and scenery — for line construction *and* maintenance. Poles, crossarms, hardware, tools—a partial list of items that are stocked at strategic Graybar locations throughout the country. All available for fast delivery to you. It pays to call Graybar . . . *first.*

From start to finish— arrange for continuing supplies and equipment—with Graybar

Engineers deep in the problems of new transmission *line construction* must be able to depend upon reliable, on-time deliveries to keep their schedules. And later, to meet the continuing task of *line maintenance*, the selection, dependable delivery and warehousing of supplies and equipment are vital.

Graybar backs up design and construction engineers to speed up these processes. Through more than 130 offices and warehouses, Graybar supplies prompt catalog information on everything electrical needed in line construction and maintenance.

To speed up the selection and delivery of anything and everything you need for line construction and maintenance call Graybar first. *Graybar Electric Company, 420 Lexington Avenue, New York 17, N. Y.*

713

CALL GraybaR FIRST FOR

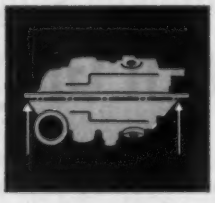
GRAYBAR ELECTRIC COMPANY, INC., 420 LEXINGTON AVENUE, NEW YORK 17, NEW YORK, IN OVER 130 PRINCIPAL CITIES

Advanced Design

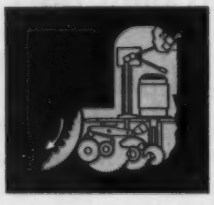
Allis-Chalmers tandem-compound steam turbine-generator units feature newest engineering developments

● From 75 mw through 250 mw, these 3600-rpm tandem-compound steam turbines utilize the most advanced design features, such as side-crossunders and primary and reheat steam valves that do not require removal during inspection, solidly bolted down non-sliding turbine pedestals, and flexibly supported hydrogen-cooled stator core.

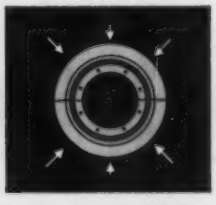
Advances in design of double and triple-flow tandem ratings to 250 mw and of 3600/3600-rpm and 3600/1800-rpm close-coupled cross-compound arrangements to 300 mw and larger are revealed in publications 03R8620 and 03R8880. Call your A-C representative for copies, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



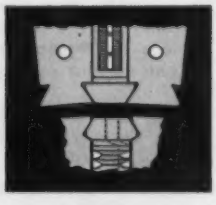
Centerline support of high-temperature turbine provides sustained concentricity of cylinder with spindle — offset parting joint adds rigidity to casing lower half without affecting the overall cylinder symmetry.



Side-mounted, underslung turning gear, for units with 23-inch exhaust blades and larger, engages shaft ring-gear below centerline — it need not be removed or electrically disconnected for unit servicing.



Ring-type nozzle chests, for 1000-1050-F inlet temperatures, are supported and keyed in inner casing, can expand freely, following spindle radial expansion. They also provide optimum nozzle orientation.

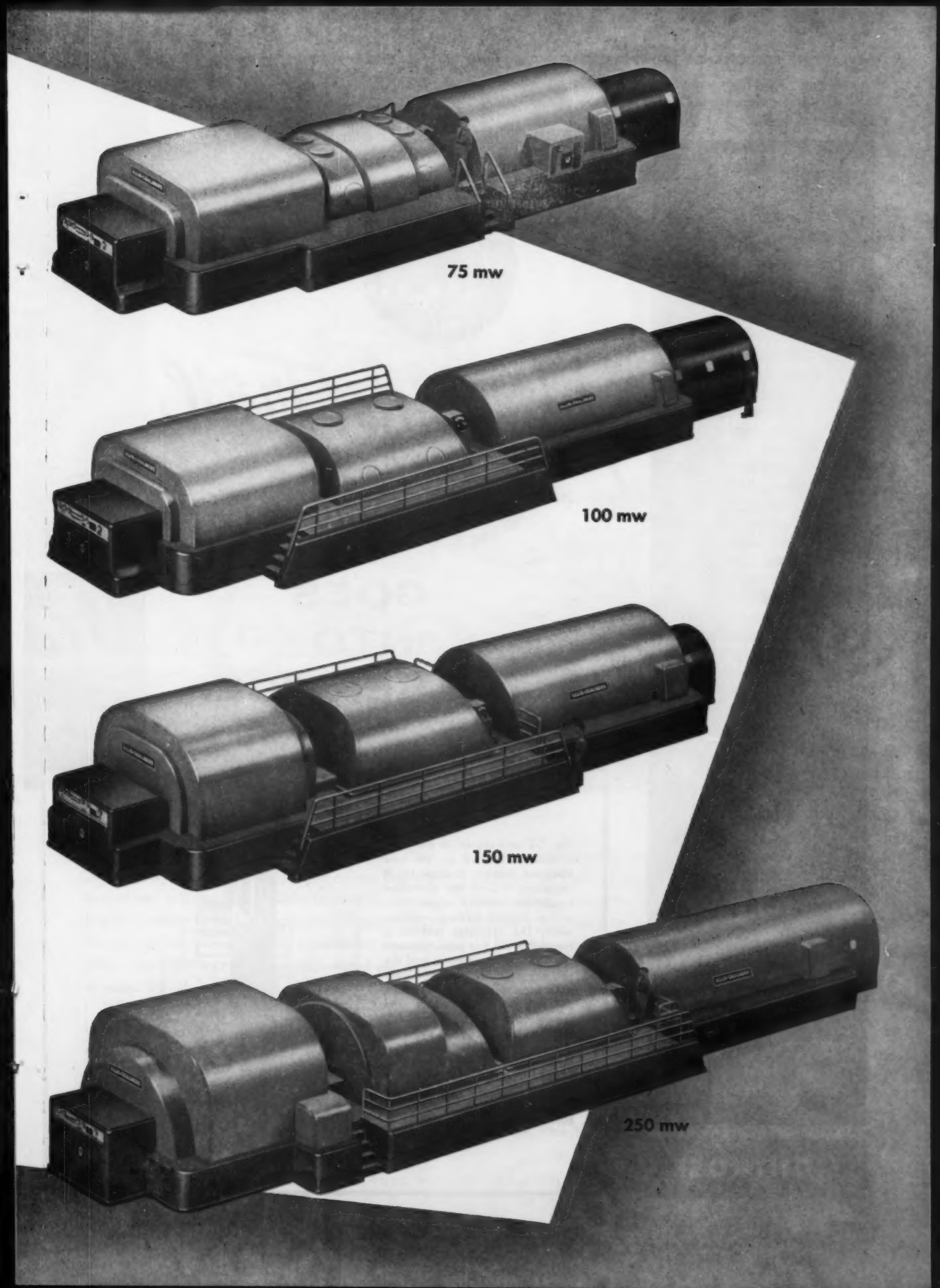


High-velocity supercharged hydrogen-cooling is employed in generator rotors for all 3600-rpm units over 50 mw—also in stators and their terminal conductors and bushings for units rated 150 mw and above.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

A-5695


75 mw
100 mw
150 mw
250 mw

NEW UTILITY STATIONS, C-E EQUIPPED

Includes only new stations on *new* sites placed in operation since JANUARY 1, 1950.

LAKE CATHERINE
HUTCHISON
YATES
DUNKIRK
TITUS
LEE
CONTRA COSTA
HAWTHORN
NINEMILE POINT
EDGE MOOR
PALATKA
JOHNSONVILLE
DANSKAMMER
BECKJORD
HIGHGROVE
PLANT X
BLACK DOG
ALBANY
JOPPA
MERAMEC
PORTSMOUTH
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AURORA
HENNEPIN
EASTLAKE
OAK CREEK
SUWANNEE RIVER
URQUHART
KINGSTON
SANDOW
MULLERGREN
BARRY
NORTH OMAHA
WILMINGTON
CARBON
SAGUARO
MORRO BAY
VERMILION
JOHN SEVIER
COLLIN
MILLIKEN
GALLATIN
BARRETT
MITCHELL
SAN BERNARDINO
YORKTOWN
GULF COAST
TUCSON
PORT WENTWORTH
W. A. PARISH
ALLEN

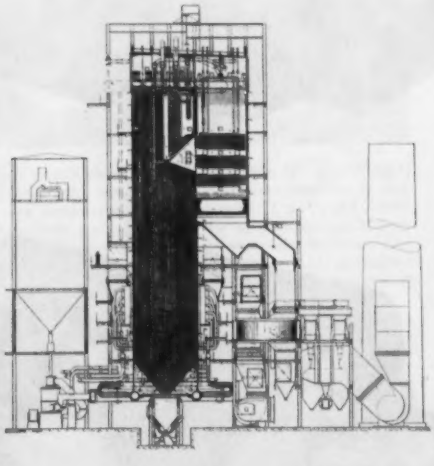
MONTROSE

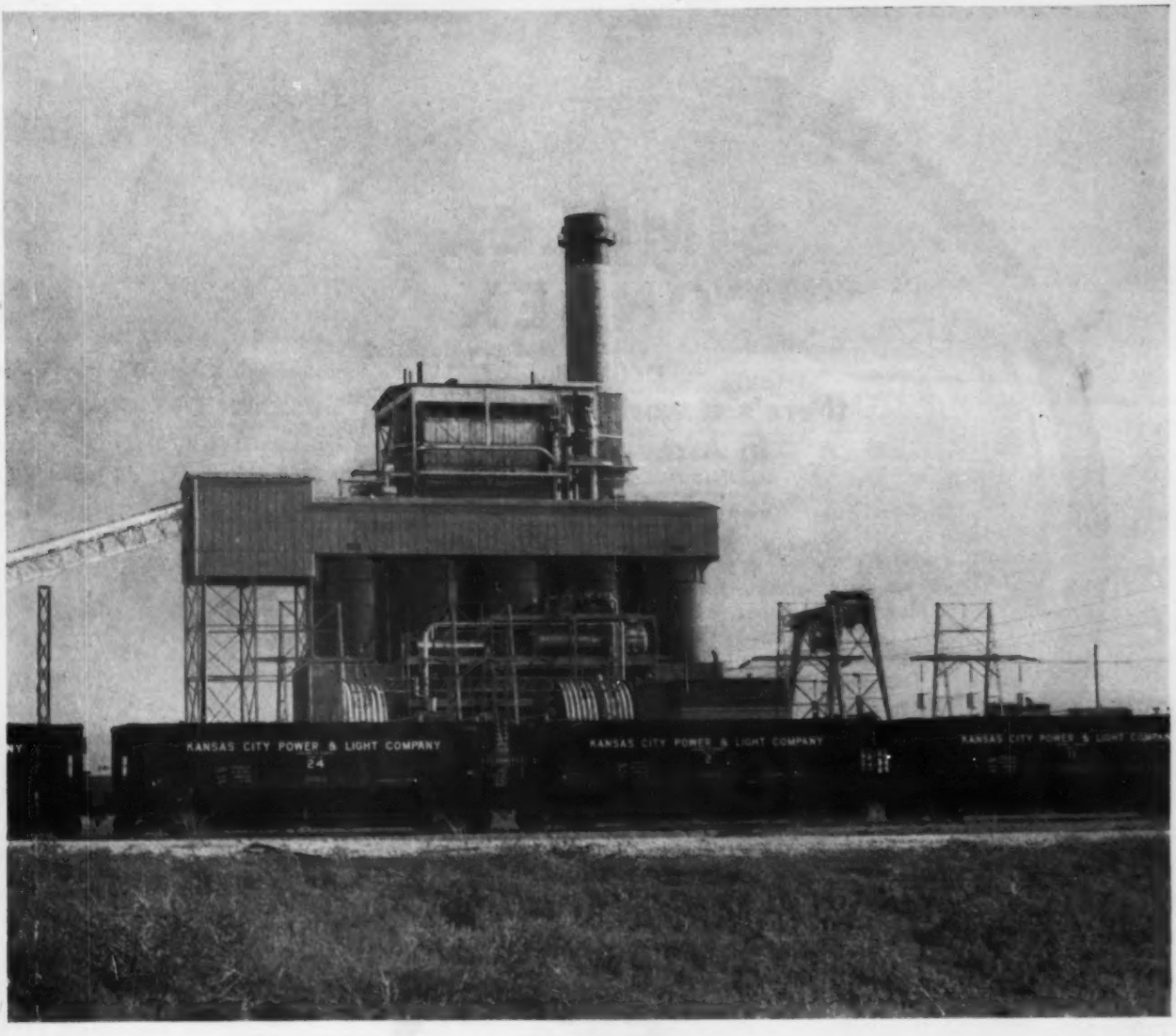
KANSAS CITY POWER & LIGHT COMPANY — 75TH ANNIVERSARY CENTRAL STATION ELECTRIC SERVICE IN KANSAS CITY

SERVING THE COMMUNITY SINCE 1883 — KANSAS CITY POWER & LIGHT COMPANY

New Montrose Station GOES INTO SERVICE

The C-E unit shown at the right is now in service at the new Montrose Station; a duplicate is on order. It is of the controlled circulation, radiant reheat type with a divided furnace arrangement. The reheater surface is located in the first pass, between the finishing superheater and the primary superheater in the rear pass. Economizer surface is below the secondary superheater and regenerative type air heaters follow the economizer. The units are designed to supply steam at a throttle pressure of 1800 psi at 1000F, reheated to 1000F. The fuel is pulverized coal using Bowl Mills and tilting, tangential burners.





Kansas City Power & Light Company—in its 75th Anniversary year—has recently put on the line the first of two 175,000 KW units at its new Montrose Station located 65 miles southeast of Kansas City; the second unit is scheduled for service in mid-1960. The plant was designed, engineered and constructed by Ebasco Services, Inc.

It is located convenient to nearby strip mines which will supply all fuel requirements. A 1500-acre lake, to provide condensing water, was constructed as part of the project. Power will be transmitted over two 154,000-volt lines to the dynamic Kansas City area.

Steam for the new turbo-generator at Montrose Station is provided by a C-E Steam Generating Unit, a cross-sectional elevation and brief description of which appear on the opposite page.

COMBUSTION ENGINEERING

Combustion Engineering Building, 200 Madison Avenue, New York 16, N. Y.

C-185

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

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proves there's a world of difference in Armored Cables

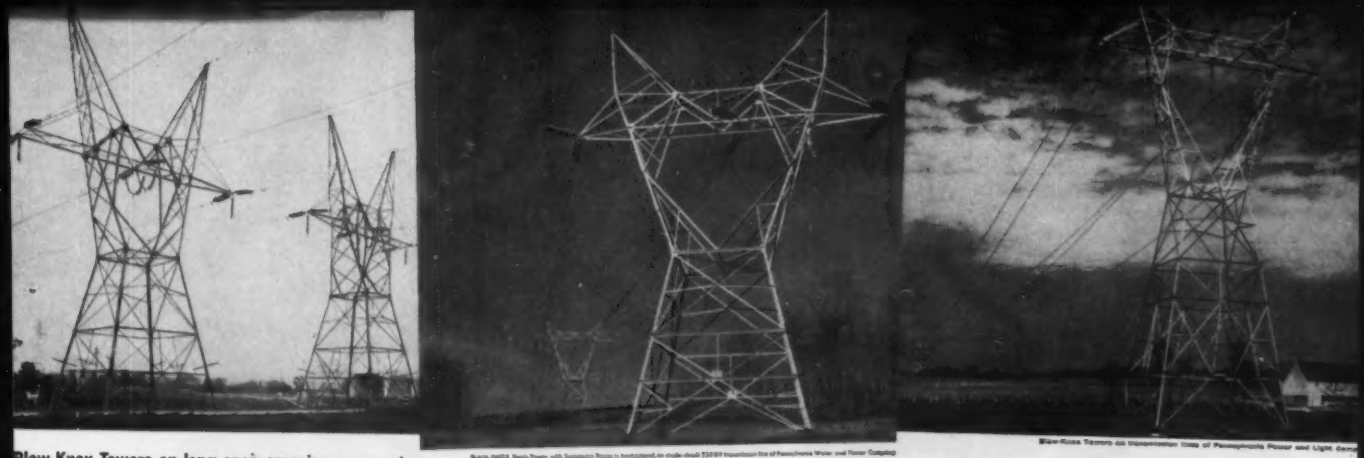
More and more, Simplex-CONDEX interlocked armored cables are being specified by industrial architects and engineers. This is so because Simplex-CONDEX has proved itself unequalled in performance in many thousands of installations. Moreover, Simplex-CONDEX permits maximum efficiency and flexibility in plant layout planning, and is easy to install and maintain. / Simplex manufactures CONDEX Interlocked Armor over its well-known ANHYDREX, thermoplastic and varnished cambric insulated cables. Simplex-CONDEX combines great resistance to crushing and mechanical damage with flexibility. These cables are individually designed for efficient operation in extremes of temperature and climate, and even harsh oils and chemicals. (Where *imperviousness* to oil and most chemicals is required, request literature on Simplex C-L-X). / Write for detailed specifications folder.

Simplex-CONDEX, armored with galvanized steel, aluminum, bronze, or stainless steel, can be applied over cable cores of up to 4" or more in diameter.

LIVE BETTER ELECTRICALLY

Simplex WIRE & CABLE COMPANY
79 SIDNEY STREET, CAMBRIDGE 39, MASS.

"Visit Booth 162, 4th National Electrical Exposition, Dallas, Nov. 18-20"



Blaw-Knox Towers on long span crossing over water

cooperative planning between Blaw-Knox and utility resulted in savings

BLAW-KNOX makes what it takes
—to carry the lines in all-weather condition

ew Blaw-Knox towers developed in cooperation with utility engine

To expand an existing line...to build a new line...
they chose BLAW-KNOX TOWERS

cial design flat top Blaw-Knox tower provides vital airlane clearanc

TRANSMISSION TOWE

TRANSMISSION TOWERS

These Blaw-Knox Towers solved problems and saved money

These are but a few of many case history reports detailing the way in which custom designed Blaw-Knox Towers continue to solve problems and save money for many utilities.

For over 40 years, Blaw-Knox has worked closely with Electric Utilities in designing and fabricating towers for every type of transmission system. From this experience have evolved basic designs combining maximum structural advantages with ease of erection. The performance record of Blaw-Knox Towers assures you . . .

- towers custom designed to best meet your individual requirements
- high quality fabrication for easy field erection

Send today for Folder 2509 . . . or tell us your needs and we'll give you our recommendations and a quotation.

BLAW-KNOX COMPANY
Blaw-Knox Equipment Division
Pittsburgh 38, Pennsylvania

BLAW-KNOX

TRANSMISSION TOWERS
Steel transmission towers, custom-built for each installation . . . Guyed and self-supporting antenna towers for AM, FM, TV, microwave, communications, radar . . . parabolic antennas and other special structures.

QUESTION:

WHAT IS MOST RELIABLE INSULATING MATERIAL FOR EXPOSED INSULATION?

ANSWER:

WET PROCESS ELECTRICAL PORCELAIN

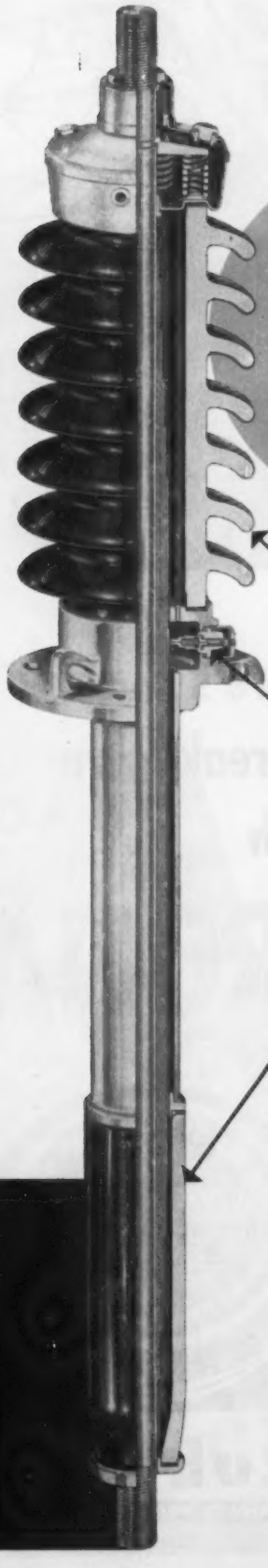
Porcelain is inorganic, non-deteriorating and rugged. At high operating voltages, it can withstand leakage currents without tracking, and without permanent damage to its surface.

Lapp

POC*

BUSHING

*PAPER-OIL CONDENSER TYPE
TOTALLY-ENCLOSED CORE
ASA STANDARD



IN LAPP POC* BUSHING DESIGN

PORCELAIN does 3 big jobs

1. WEATHER CASING of porcelain provides flashover distance . . . protects insulated core from moisture and weather . . . and with Lapp Fog-Type corrugations provides most-effective surface to withstand leakage currents under atmospheric contamination.

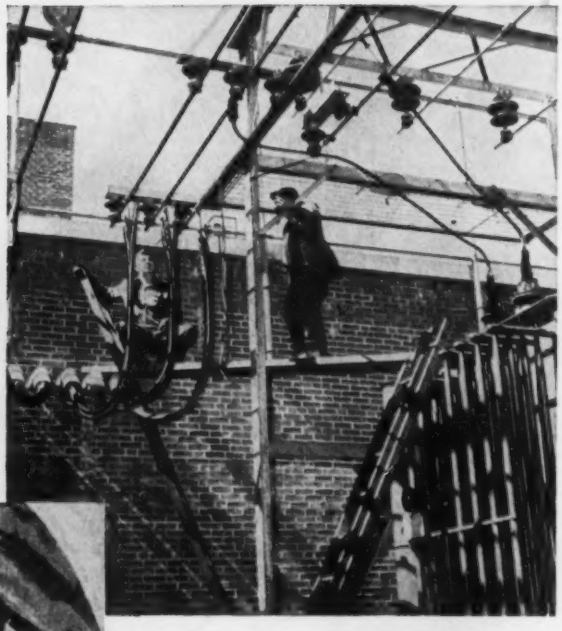
2. POWER FACTOR TAP is insulated by porcelain; provides permanent uniform insulation . . . assures reliability of power factor test readings.

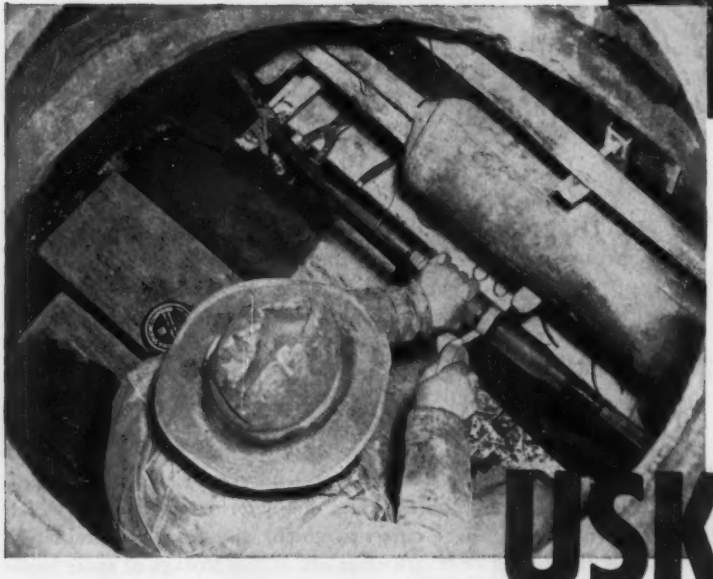
3. SHANK of porcelain encloses paper-oil core, isolates it from oil in the tank. It has a non-tracking, non-deteriorating surface which will withstand leakage currents which arise from contamination of circuit breaker or transformer oil. Makes storage of spare bushings easy, too, because porcelain shank requires no protection from natural elements.

Lapp Insulator Co., Inc., Le Roy, N. Y.

ALL EXPOSED INSULATION ON EVERY LAPP POC* BUSHING . . . FROM 15kv UP . . . IS LAPP VACUUM-PROCESS PORCELAIN

Overhead or Underground





There's never a breakdown with USKORONA tape

On splicing or terminating electrical cables on underground power lines, street lighting circuits and transformer leads, on secondary network systems—to name just a few—Uskorona tape is *essential* because it is the only tape that is resistant to both ozone and moisture. It fuses with and becomes a part of the insulation and gives the same dielectric strength as the original insulation. Naturally, it exceeds A.S.T.M. specifications.

Uskorona® was developed to assure ozone and moisture protection to high voltage lines. Here's how good Uskorona is:

- In a corona-(ozone) resistance test of 4 leading brands, Uskorona was the only tape still intact after 4 hours of exposure.
- Even after 1500 additional hours of continuous exposure, Uskorona remained as fresh and corona-resistant as at the start.

When you think of rubber, think of your "U. S." Distributor. He's your best source of on-the-spot technical aid, quick delivery and quality industrial rubber products.

Mechanical Goods Division

United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

Connect COPPER with COPPER ALUMINUM with ALUMINUM

use...

PAC-5
ACSR 6—1/0 Cu. 8—1/0

PAC-3
ACSR 8—2 Cu. 8—2

PAC-4
(formerly PAC 6—0)
ACSR 6—1 0 Cu. 6—2

PAC-7 (replaces PARC 6—0)
ACSR 1 0—336.4
6—1 0 A R Cu. 8—1 0

BLACKBURN COPPER TO ALUMINUM FITTINGS

BLACKBURN PAC CLAMPS

ELIMINATE CORROSIVE SOLDERS, VOIDS AND FLUXES !

There are many satisfactory copper connectors for connecting copper conductors.

There are many satisfactory aluminum connectors for connecting aluminum conductors.

Blackburn's PAC clamps combine the features of a good copper connector and a good aluminum connector to give you the best copper to aluminum connector available.

Our exclusive method (Patent applied for) of pressure casting molten corrosion resistant aluminum alloy around specially treated pronged copper liners establishes an intimate, low resistance contact of the two metals without using corrosive solder.

The copper liners, which cannot be mated incorrectly, surround the copper conductor establishing a good copper to copper contact.

The aluminum grooves surround the aluminum conductors, establishing a good aluminum contact.

Adequate contact surface and conductor separation is built into Blackburn's PAC clamps to insure long-lasting, trouble-free copper to aluminum connections without setting up cold flow or galvanic corrosion.

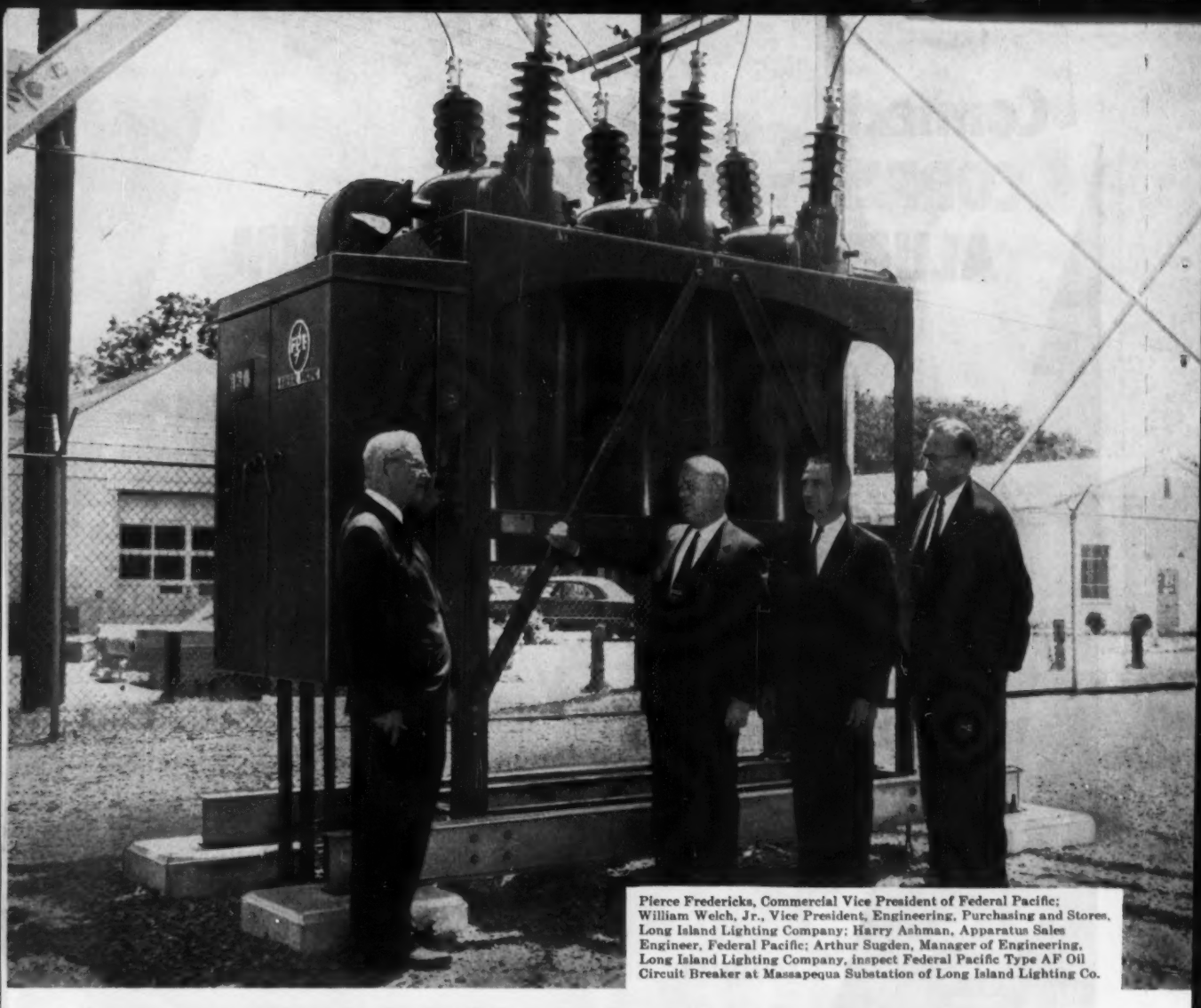
Spring action is inherent in the design of PAC clamps and is supplemented with an extra-heavy spring lockwasher insuring permanently tight connections which will withstand temperature fluctuations.

Hot dipped galvanized steel hardware is standard. Aluminum hardware available on all but Catalog #PAC-3.

AVAILABLE THROUGH ELECTRICAL WHOLESALERS EVERYWHERE

JASPER BLACKBURN CORPORATION

1525 WOODSON RD., ST. LOUIS 14, MO.
WYdown 3-9430



Pierce Fredericks, Commercial Vice President of Federal Pacific; William Welch, Jr., Vice President, Engineering, Purchasing and Stores, Long Island Lighting Company; Harry Ashman, Apparatus Sales Engineer, Federal Pacific; Arthur Sugden, Manager of Engineering, Long Island Lighting Company, inspect Federal Pacific Type AF Oil Circuit Breaker at Massapequa Substation of Long Island Lighting Co.

ANOTHER NEW FEDERAL PACIFIC OIL CIRCUIT BREAKER ON THE JOB

This new 34.5 kv type AF oil circuit breaker is one of many Federal Pacific breakers used by the Long Island Lighting Company. Employed as a line breaker on a sub-transmission line, this type AF breaker—like all Federal Pacific equipment—is ready to perform as specified.

Here are some of the advantages utilities gain by specifying Federal Pacific type AF oil circuit breakers:

RAPID ARC EXTINCTION—extreme simplicity of interrupters...*no* moving parts...superior condensation-type arc extinction principle. Oil injection into the hot gas bubble accelerates condensation and cooling...results in high dielectric recovery rate...prevents arc re-ignition at proper gap distance with minimum pressure build-up and erosion.

TYPE OA HYDRAULIC OPERATING MECHANISM—ultra-rapid response, 100% trip-free under *all* conditions, safe and proven dependable.

HIGHEST MECHANICAL SAFETY FACTOR—demonstrated by an ability to withstand an indefinite number of no-load operations without oil in the tanks. Uses no dash-pots in the tanks.

RIGID FRAME DESIGN—functionally designed frame provides trim lines with exceptionally strong joint construction. Oil gauges and position indicators clearly visible from ground level.

LOW MAINTENANCE COSTS—factors such as the extremely simple method of interruption, the precise positioning of contacts, the overall "built-in" simplicity, result in outstandingly low maintenance needs.

For full details of the many advantages offered by Federal Pacific type AF oil circuit breakers, call your Federal Pacific engineer or write Federal Pacific Electric Company, 50 Paris Street, Newark 1, New Jersey.

FEDERAL FPE PACIFIC

Better Products to Control Electricity

The Electrical Week

LATE NEWS ▶ **New AFL-CIO A-power committee will hold first meeting Nov. 25.** Composed of men from 14 affected unions, the technical group will deal mainly with items like safety and workmen's pay, but also may get into power development program controversy.

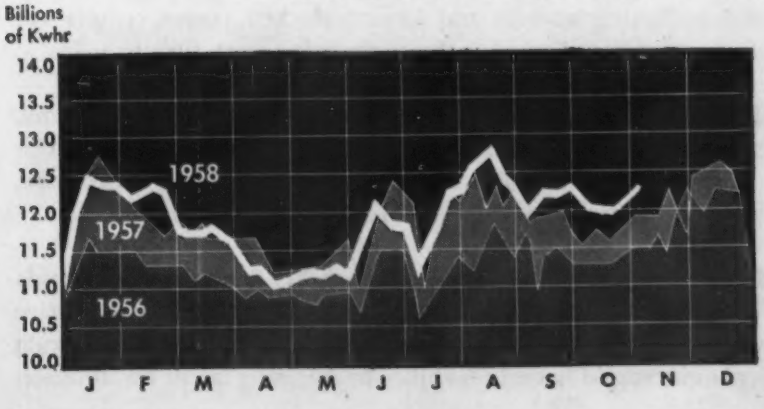
Atomic highlights . . . U.S. and Euratom sign pact on building of six large-scale reactors in Western Europe. . . . Sargent & Lundy undertakes design study of heavy-water moderated plant for AEC . . . Westinghouse gets first AEC license for export of PWR to Belgium . . . First Georgia Power reactor school grads get diplomas.

Rate changes . . . Illinois power gets ICC approval to up electric rates $3,066,745 a year vs $4,464,826 sought . . . Ohio Ed hopes to get $773,000 a year increase in Akron when rate ordinance expires Jan. 17.

Central P&L urges city wide vote on its $9,634,000 offer for Brownsville, Tex., system . . . Dayton P&L offers Greenfield, Ohio, $977,331 for plant and distribution system, exclusive of buildings . . . Indiana & Michigan Electric gets okay to buy Monroe, Ind., system for $50,000.

Management changes . . . Southern California Edison elects Harold Quinton chairman, succeeding W. C. Mullendore, retired, and J. K. Horton, Pacific G&E vp and head of Alberta & Southern Gas, becomes Southern Cal president, effective Feb. 1 . . . R. N. Haskell moves up from executive vp to president, Bangor-Hydro, succeeding E. M. Graham, who remains chairman . . . Other promotions: Gulf States Utilities, E. A. Werner to vp; Oliver Electrical Mfg, C. R. Dudley, vp-sales; Southern States Equipment, Glenn Mitchell president, succeeding O. Richardson, chairman and chief executive, and W. C. Mitchell, executive vp; Enjay Co, J. E. Wood, III, president; and Federal Pacific, R. L. Bobo, vp-marketing.

POWER OUTPUT—UP 3.3% (Week ending Nov. 8), Kwhr 12,311,000,000



Per Cent Change From Previous Year

	Oct. 25	Nov. 1	Nov. 8
Total U. S. ..	+3.3	+4.0	+3.3
New Eng. ...	+5.3	+6.0	+6.0
Mid. Atlantic.	+3.1	+3.6	+3.4
Cent. Ind. ..	+0.2	+2.5	+2.9
West Cent. ..	+1.8	+3.5	+2.2
Southeast ...	+1.9	+2.9	+2.7
South Cent. .	+11.9	+7.3	+5.1
Rocky Mount..	+9.7	+9.9	+5.9
Pacific			
NW	+1.6	+3.6	−0.2
SW	+7.7	+5.9	+5.5

Seasonally Adjusted Index 237.4
Week Ago 238.5 Year Ago 229.5

Source: Edison Electric Institute

A TWO-MINUTE PREVIEW OF THIS ISSUE

EVENTS ▶ **Power companies got a vote of confidence in Oregon,** as voters there turned down three public power measures Nov. 4, also elected a Republican governor whose opponent was allied with the National Hells Canyon Assn. And other elections around the U. S. decided issues affecting the power companies. For a roundup story on these local elections, turn to p 66.

EEI is leery of the long-range atomic power program advanced by Joint Committee on Atomic Energy staff. The program should affirm participation and ownership by private enterprise, EEI says (p 67).

Fireworks follow an appeal for higher interest rates to co-ops on REA loans. Agriculture Dept's spurring of debate brings attempt to muzzle REA Administrator Hamil, "cloak and dagger" charges (p 68).

"A blend of mental free wheeling" and practical, organized approach to problems was advice of Don Mitchell, head of Sylvania, at annual NEMA meeting. Speakers stressed need for more research, stepped-up sales and promotion programs. Joe Singleton, Allis-Chalmers vp, was re-elected president. New NEMA vps are Chris Witting, Westinghouse, and W. R. Persons, Emerson Electric (p 69).

ATOMIC ▶ **How much does nuclear power cost?** Not enough experience has been gained yet to make exact answers easy, but here is a four-page report gathering together the factors that must be considered in the inexact science of nuclear plant cost estimation. It includes discussions of fuel costs and plutonium credits, capital costs and depreciation, maintenance, insurance and manpower, pointing out some of the similarities and differences between nuclear and conventional power plant operation (p 72).

INDUSTRIAL ▶ **A new coal preparation plant will use 14,000 hp in motors** to insure high efficiency and continuous operation. Clinchfield Coal Co's Moss No. 3 plant in Dante, Va., handles 1,500 tons of run-of-mine coal per hr using a total of 427 motors from one to 400 hp plus 109 fractional-hp motors. All important pumps have standbys, and extra capacity is designed into critical production areas. Group starting, ground indicating systems and key-interlocked power centers are also features of the plant. For the engineering story turn to p 76.

GENERATION ▶ **Air heater hot spots can be detected quickly** with a wire and ceramic temperature sensing circuit used by Public Service Electric & Gas Co. The control unit consists primarily of a Wheatstone bridge, relay, and potentiometer, responds from 200 to 1,000 F (p 94).

RELAYING ▶ **Modernized relaying uncovered a capability bonanza** for Florida Power Corp. With an investment of about $3 million in protective relays, metering, and circuit breaker control equipment, the Florida utility has increased system capability by releasing latent transmission

capacity. The program has also standardized relay schemes, cutting expense of engineering, installation, and maintenance (p 79).

MANAGEMENT ▶ **Next three years will show rapid growth with ample gross margins,** according to Edison Electric Institute's 24th Semi-Annual Electric Power Survey completed last month. Although estimates of output, peak loads, and capability have been shaved since the 23rd Power Survey last spring, the 1958 December peak is expected to show an 8.6% increase over last year's. 1958 output will be only 3.1% above the 1957 total, according to the survey, but a 10.9% rise is due for 1959. And gross margin, up to 25.5% this December, is expected to drop back to 23.7% by 1961 (p 129).

SELLING ▶ **Medallion Home modernization has started in the Midwest.** The area's first remodeled home has tripled load from 380 to 1108 kwhr per month. The residence in Commonwealth Ed's service area was awarded the LBE symbol for meeting modernization standards (p 122).

A special 4-page section on industrial applications is inaugurated in this issue. Cost-cutting ideas for industry include: An automated aluminum-extrusion line, electric conveyors in a sawmill, lighting for an engineering office, a conveyorized paint-drying oven, infrared curing of sheer fabrics, electric heating for a truck terminal, and a time-saving application of plug-in bus duct (p 81).

MANUFACTURERS ▶ **First all-aluminum transmission towers in the U. S. are planned** by Public Service Electric & Gas Co in cooperation with the Aluminum Co of America. PSE&G will use more than 60 of the towers in an 11-mi line . . . Westinghouse Electric Corp will put a new test reactor into operation next May near Waltz Mill, Pa. The water-cooled and moderated thermal neutron reactor will operate initially at 20 Mw, and will be used to subject materials and fuels to conditions similar to those in an operating power reactor (p 98).

NEW EQUIPMENT ▶ **Interchangeable bushings can be used in transformers or breakers,** with only eight basic bushings required in standard voltage classes from 23 to 196 kv . . . Adjustable pole-band mounting brackets simplify installation of one, two, or three single-phase transformers of ratings from 3 through 167 kva . . . Remote control mechanism can be used on molded-case circuit breakers. The mechanism can be in-service mounted, adds only 6 in. to depth of breaker (p 104).

PEOPLE ▶ **William B. McGuire has been named president of Duke Power Co,** effective Jan. 1, 1959. He will succeed Norman A. Cocke, who is retiring . . . Foster Wheeler Corp has appointed Lawrence S. Pricher vice president-finance. He will be in charge of all fiscal and financial affairs . . . AIEE has awarded a plaque to J. H. Foote, president and chief engineer of Commonwealth Associates, Jackson, Mich. (p 137).

Accounting is the language of business and because it is, anyone hopeful of attaining managerial rank should be familiar with the basic principles of accounting. A recently published book entitled "Accounting for Non-Accountants" should assist anyone who wishes to broaden his business skills. The book is clearly written with the emphasis on understanding rather than doing. The simplicity of the presentation should enable the reader to use this text for a self-study course.—**Accounting For Non-Accountants. By J. N. Myer. Published by New York University Press, Washington Square, New York 3, N. Y. 227 pages, illustrated. Price $5.00.**

TECHNICAL NOTES

Detonation (rapid rise to an extremely high pressure with equally rapid decay) rather than an explosion (more sustained at lower pressure) appears to occur when a combustible mixture of hydrogen and air are ignited in a confined space, such as a turbine generator, according to tests conducted by a turbine generator manufacturer.

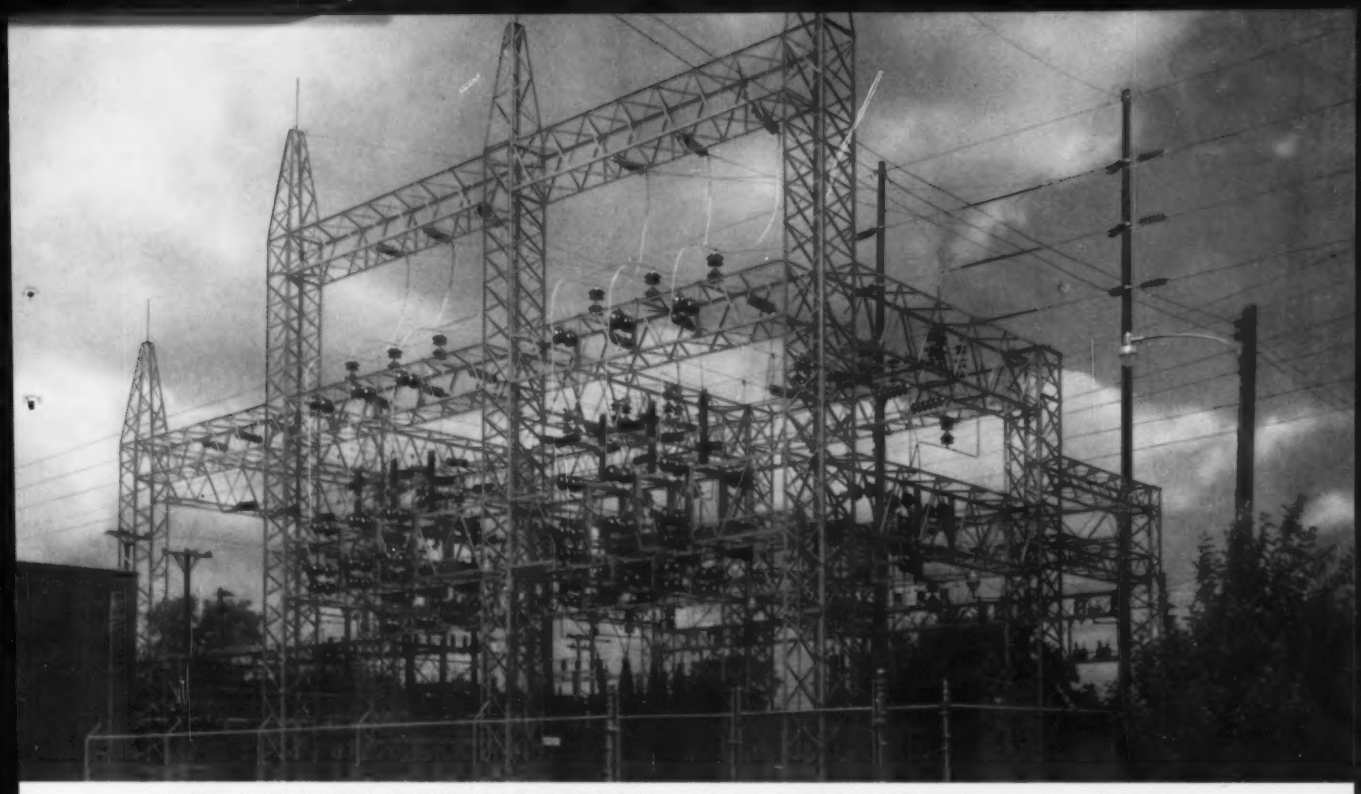
Lower voltage motors, because of their heavier winding copper, are less vulnerable to winding damage from mechanical stress if the motor residual voltage is out-of-phase with the reserve source following a trip out.

There is a tendency for generator rotors of large modern machines to reach tripping speed at a faster rate because as ratings have been increased it has been possible to develop generators without a comparable increase in the size of the rotor.

Air entrainment considerably improves the workability of concrete, particularly when crushed coarse and fine aggregates are used.

FROM EDITORS IN THE FIELD

Dynamic peak loads due to conductor breakage are 30% less on fully flexible guyed portal towers than on rigid self-supported ones, according to Finnish engineers. They claim that the forces due to conductor breakage and windloads will, through the guy anchors, cause only compression in the tower legs and foundations. However, the portal towers require more ground area.



LARGE URBAN-TYPE L-M PACKAGED SUBSTATION, designed by Line Material and erected in minimum time with L-M prefabricated steel. Incoming lines are 69 kv; outgoing are 7.2/12.47 kv. L-M engineers design these packaged stations in sizes from 5 to 161 kv, for industrial plants, and for rural and urban locations on utility company lines—all with completely coordinated plans, structure, and equipment.

L-M-Engineered Packaged Substations Save Planning and Construction Time

by **W. V. SWAN**, Product Manager
Substations and Power Switching Equipment
Line Material Industries

Line Material packaged substations offer wide choice of design and application; considerable flexibility and provision for future expansion; great savings in engineering and ordering for utilities. And, because of L-M's unique prefabricated steel structure, these substations are fast and easy to erect.

One Order Does It!

Completely coordinated L-M substations need only one order; are delivered either as one shipment or coordinated to your construction schedule. It's easy to order an L-M substation. Just give us a one-line diagram of what you want—or tell us your voltage, kva requirements, number of incoming lines and outgoing feeders, and area available—and we'll design your substation for you!

Fast Erection

L-M's pre-engineered steel trusses and columns are completely prefabricated, and shipped knocked down or factory-assembled. Structures are steel, or aluminum alloy. Members have round holes punched at 3-inch intervals (before galvanizing) with square holes every foot. This eliminates measuring and drilling, and damage to galvanizing. Holes accommodate all bolts for lacing members and apparatus. That's why they go up so fast.

Prompt Shipment

Structural steel can be shipped in 3 to 4 weeks after final approval of order; complete stations in 4 to 12 weeks. Station design provides for easy, safe accessibility to all equipment. Stations meet NEMA, ASA and AIEE standards.

Ask the L-M Field Engineer for complete information and bulletins; or write Line Material Industries, Substation Department, Milwaukee 1, Wisconsin.

LINE MATERIAL Industries
McGRAW-EDISON COMPANY

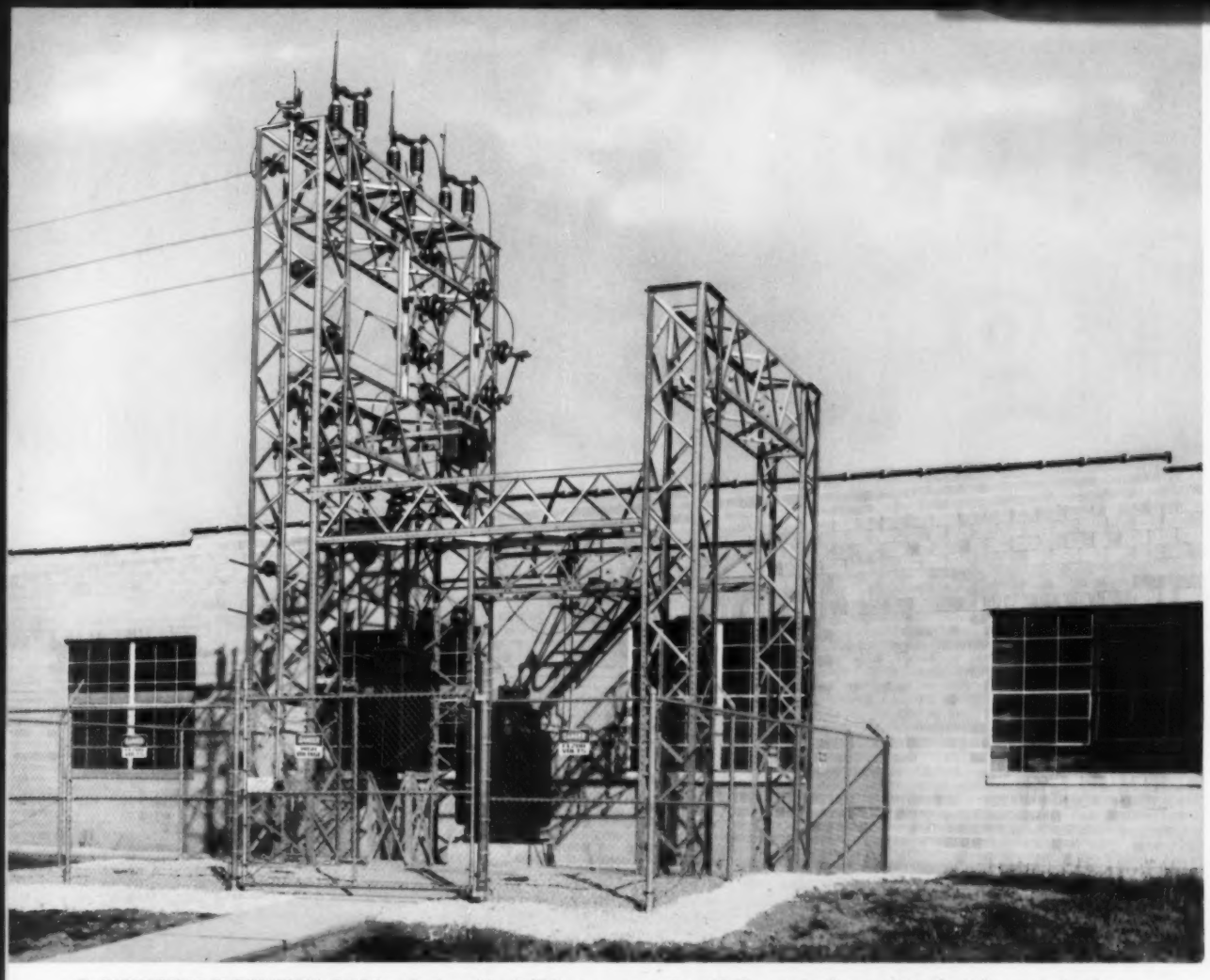
327

Packaged Substations

McGRAW EDISON

See next page

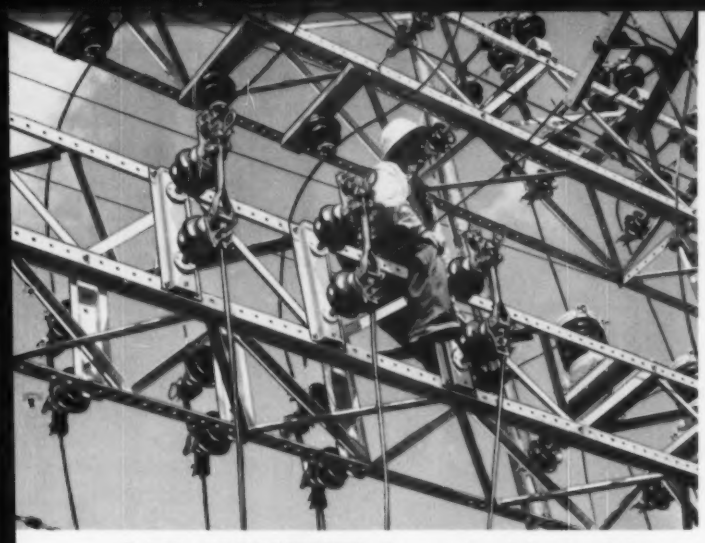
DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT



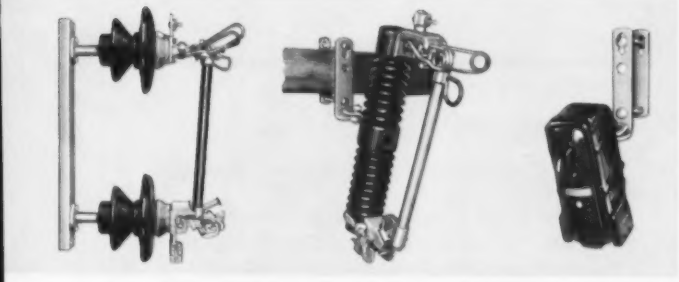
● **INDUSTRIAL SUBSTATION, 34.5 kv, designed by L-M for a midwestern plant. This station was built with L-M's standardized steel structural members, which greatly speed up erection. "Putting up L-M's prefabricated structures is easy," said the general superintendent for a contractor who erected several L-M packaged substations. "All parts are clearly numbered, all holes are punched, ready for bolts. Trusses go together in nothing flat!"**

● **CONCRETE FOOTINGS can be poured in advance, as L-M forwards complete drawings, bills of material, and anchor bolt plans well ahead of equipment. This avoids double handling and allows you to plan the work for the line crews—saving you money two ways.**

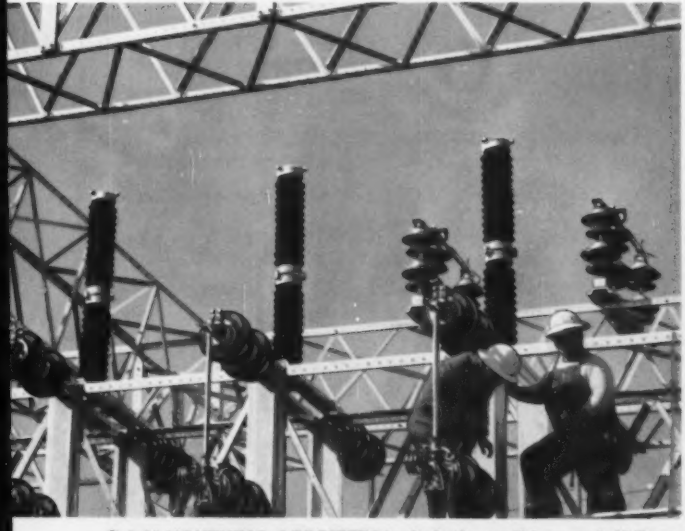
● **CHORD MEMBERS have round holes punched at 3-inch intervals, square holes every 12 inches. No holes to drill, no measurements to make, no welding. The whole structure bolts together quickly and easily—or, if desired, columns and trusses can be factory-assembled.**



● **L-M's HOOK-OPERATED disconnect switches are being positioned on the steel structure. Equipment like this is mounted in a minimum amount of time, by simply bolting equipment to the pre-punched holes. No drilling means preserving the original galvanizing on the steel, thus lengthening the life of the structure and reducing maintenance.**



● **HXO POWER FUSES and HDO cutouts are rated up to 48 kv and 200 amperes, with up to 20,000 amperes interrupting capacity. L-M enclosed cutouts for secondary circuits are rated up to 7.8 kv, 100 amperes.**



● **L-M LIGHTNING ARRESTERS include the well-known L-M Type E glass-housed distribution arrester, the L-M Type F "Ultra-Valve" intermediate arrester up to 73 kv shown here, and station-type arresters up to 161 kv.**

● **INSTALLING L-M 69 KV 600 AMPERE air break switches. L-M PV switches have many desirable features: easy operation, special lever advantage for breaking ice or corrosion, high thermal capacity. Ball bearings are lubricated for life with silicone grease, sealed in with silicone cord rings. Silicone grease and rings are not affected by temperature or moisture.**

L-M Packaged Substations Offer THESE 7 ADVANTAGES

1. One responsible supplier, with an enviable reputation for advanced research and engineering in distribution apparatus.

2. Savings in engineering time, with standard pre-engineered designs that still offer you maximum flexibility.

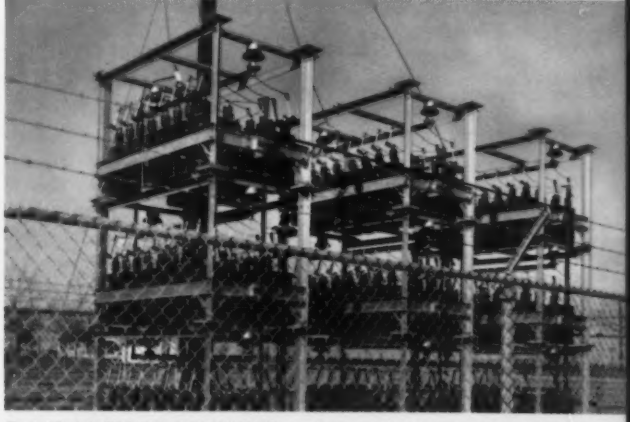
3. Convenient ordering procedure: one purchase order brings you the substation you need—saves purchasing and follow-up time and assures your receiving everything you need.

4. Coordinated shipments, as one shipment or coordinated with your work schedule, give assurance that everything will arrive when and as your line crews need it.

5. Economical structure, designed for you from standardized pre-punched steel (or aluminum) members, makes erection and equipment mounting simple and very economical.

6. Easy maintenance is provided through safe clearances and accessibility to all operating equipment.

7. Flexibility is achieved through wide choice of designs, and through provisions for adding bays to structures already erected.



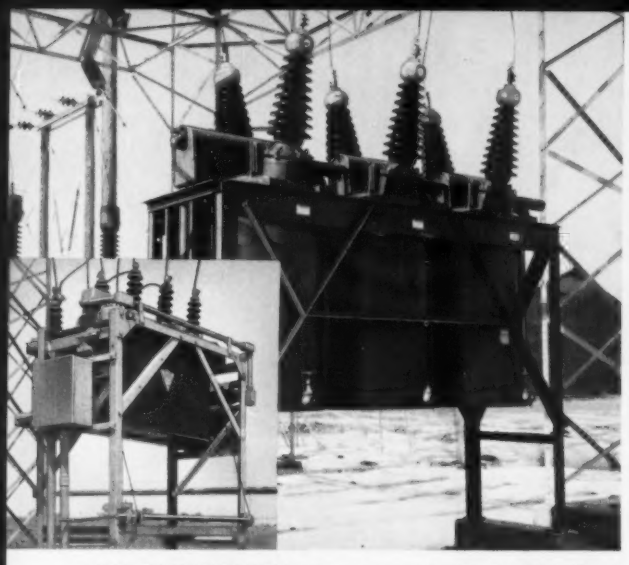
● **L-M FACTORY-ASSEMBLED and pre-wired capacitor blocks make up this bank. Capacitor equipments, blocks and banks to any size.**

See next page

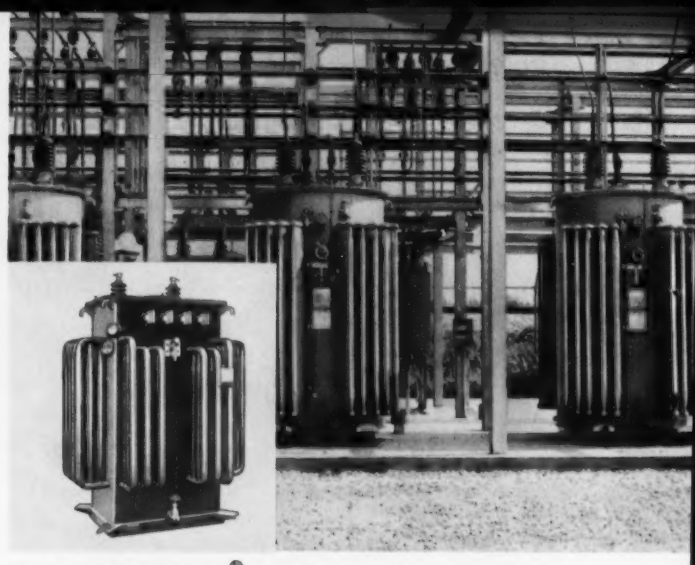
LINE MATERIAL Industries *Packaged Substations*

McGRAW-EDISON COMPANY

McGRAW EDISON



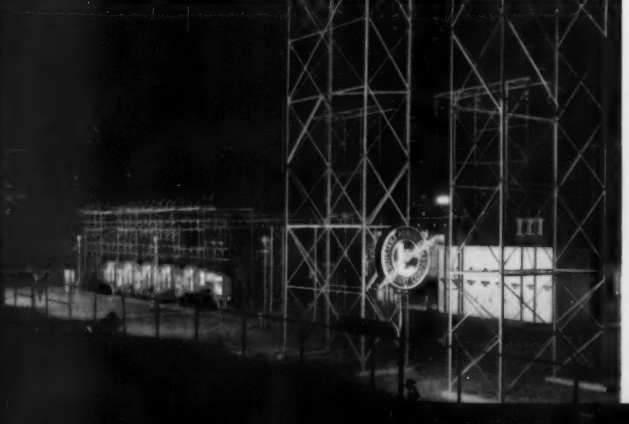
● **FOR FAST CLEARING of temporary faults, the Kyle Type W recloser is outstanding; is suitable for applications up to 200 mva. For heavier duty we supply oil circuit breakers and protective equipment for all kv classes and interrupting capacities required. In smaller neighborhood substations we can supply Kyle-Klad metal-enclosed equipment with Type R or W reclosers up to 14.4 kv.**



● **L-M ROUND-WOUND® distribution transformers are provided for ratings up to 500 kva, 69 kv, and power transformers in larger sizes up to 100,000 kva and 230 kv.**

● **L-M PERMALINE FIBRE CONDUIT is available in 2 to 6-inch diameters, 5, 8, and 10-foot lengths. Complete line of bends, adapters, bell ends, etc., for easy installation and drawing of cable.**

● **L-M's FLUORESCENT FIXTURES for substations supply even, glare-free lighting that provides extra safety for night work. Also available is a full line of incandescent and mercury vapor equipment.**



A Complete Line of Equipment For L-M Packaged Substations

All components are electrically and mechanically coordinated by Line Material to assure you that your substation will function as a well-balanced, efficient unit. L-M equipment supplied includes the following:

L-M prefabricated steel (or aluminum) structure.

All bus supports, insulators, clamps, hardware.

Air break and disconnect switches 7.5 through 161 kv, 1200 amperes. Power fuses and heavy-duty cutouts.

Distribution, line and station-type lightning arresters.

Distribution transformers through 500 kva, 69 kv, and power transformers through 100,000 kva, 230 kv.

Kyle reclosers through 23 kv; oil circuit breakers in all kv classes and ratings.

Feeder voltage regulators in distribution and power classes up to 2500 kva, 69 kv.

Capacitor equipment, blocks, banks to any size.

Conductor, bus, underground cable, and fibre conduit; lighting equipment for the station.

McGRAW EDISON

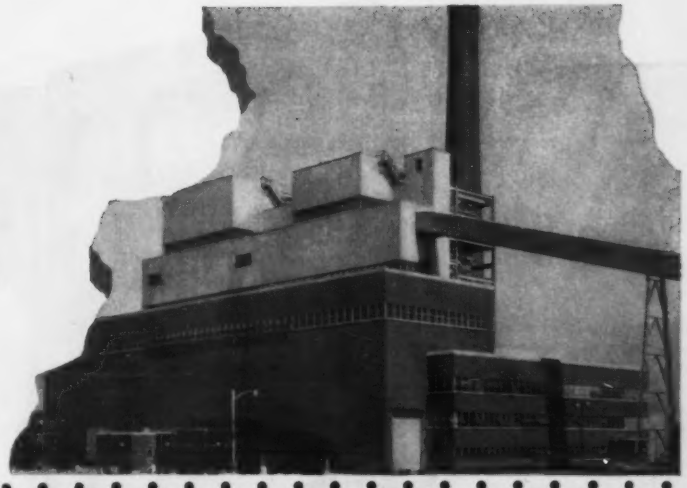
LINE MATERIAL Industries

McGRAW-EDISON COMPANY

Packaged Substations

Another addition for

ILLINOIS POWER COMPANY

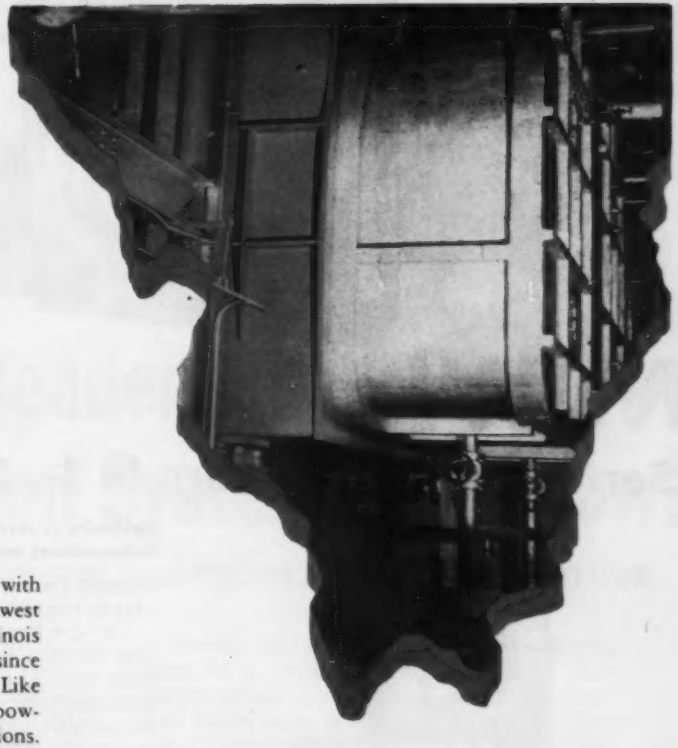


Another installation of

REVERE

Arsenical Admiralty

CONDENSER TUBES



The Vermilion Power Plant, near Danville, Illinois, with a total generating capacity of 183,000 KW, is the newest addition to the electric generating facilities of the Illinois Power Company. It is the fourth such station built since the start of a construction program begun in 1944. Like its predecessors, it has every modern device to assure power at the flick of a switch at all times under all conditions.

Helping to make this unfailing performance possible are 162,288 pounds of Revere Arsenical Admiralty condenser tubes in the #2 condenser. Water, which passes through the tubes, is pumped from a 120-acre lake created by damming up a ravine formed by the Vermilion River.

Revere Arsenical Admiralty metal was selected to fit the operating conditions encountered in this specific operation. Other conditions require other alloys. It is this careful selection of the "tube to fit the job" that has built, for Revere, a reputation for dependable condenser tube performance under all kinds of operating conditions.

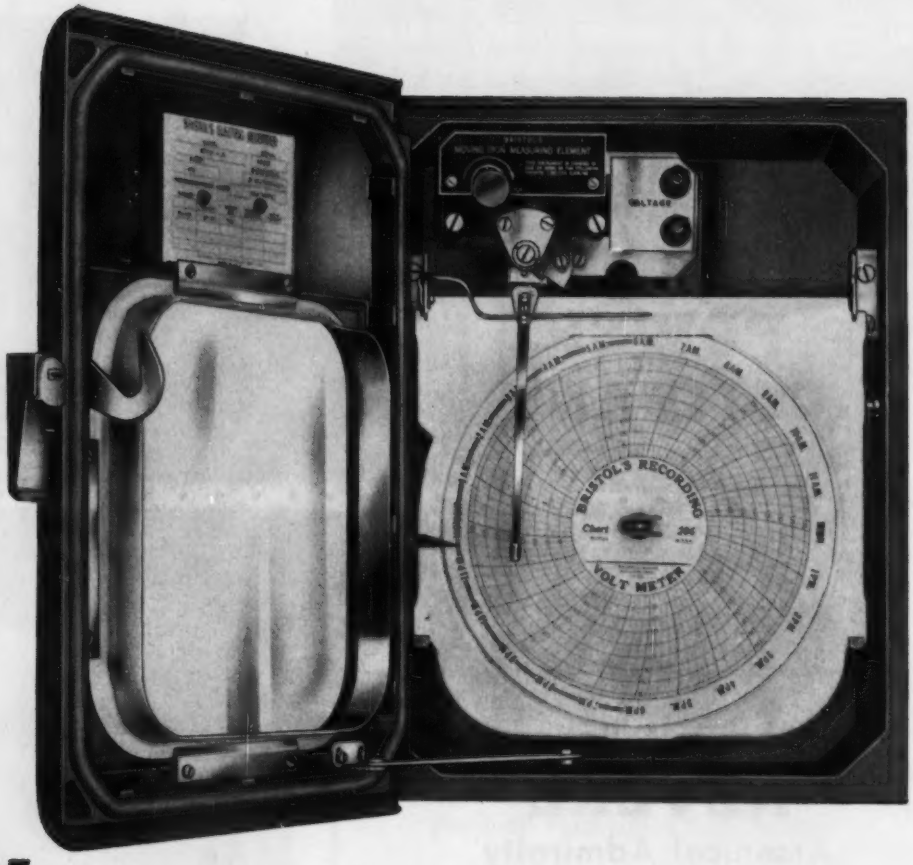
Over the years Revere's Research Department has compiled extensive data regarding the relative corrosion resistance of the different alloys under a wide variety of operating conditions. Why not take advantage of this storehouse of facts and consult with Revere's Technical Advisory Service before selecting the tubes for your equipment?

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

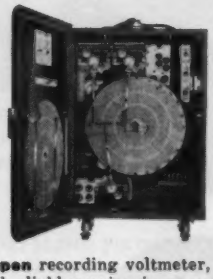
Mills: Rome, N. Y.; Baltimore, Md.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Brooklyn, N. Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities, Distributors Everywhere.



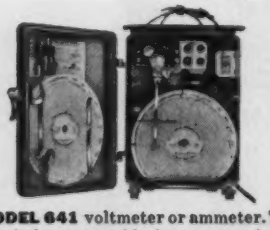
BRISTOL single-pen recording voltmeter for permanent surface or flush-panel mounting. Available for conduit or open terminal connections. Also made in portable and pole-mounting models.

NOW!

Series 500 voltmeters in 1-, 2-, and 3-pen models



New Bristol 3-pen recording voltmeter, portable model, features proved reliable moving-iron measuring elements. Ideal for checking balance in 3-phase systems.



BRISTOL MODEL 641 voltmeter or ammeter. This extra-compact folded-chart portable instrument is a favorite with utility men. 1- or 2-pen types only.

Bristol's recording voltmeters can now have as many as three independent moving-iron elements. Similar ammeters available

Rugged, precise (±1%) Bristol recording voltmeters are now available to record up to three independent voltages on a single chart.

The new 3-pen voltmeter uses the same durable, precise moving-iron elements tried and proved in Bristol single-pen and two-pen voltmeters. And like these field-proved Bristol instruments, the new 3-pen voltmeter comes in types for portable, portable and pole mounting, or wall, switchboard or flush-panel mounting. Single or double range. Check these outstanding features.

High Accuracy – ±1% of full scale.

High-torque moving-iron mechanisms – produce greatest torque possible, keep weight and power drain to minimum, assure positive recording over full range.

Low electrical burden – 5.5VA at 120V or 12VA at 240V for each mechanism.

High stability of calibration – seldom requires calibration.

Easy calibration in field – no special tools or skills required.

Rugged construction – shockproof bearings, pen locking device for shipping or carrying portable models.

Leveling not critical

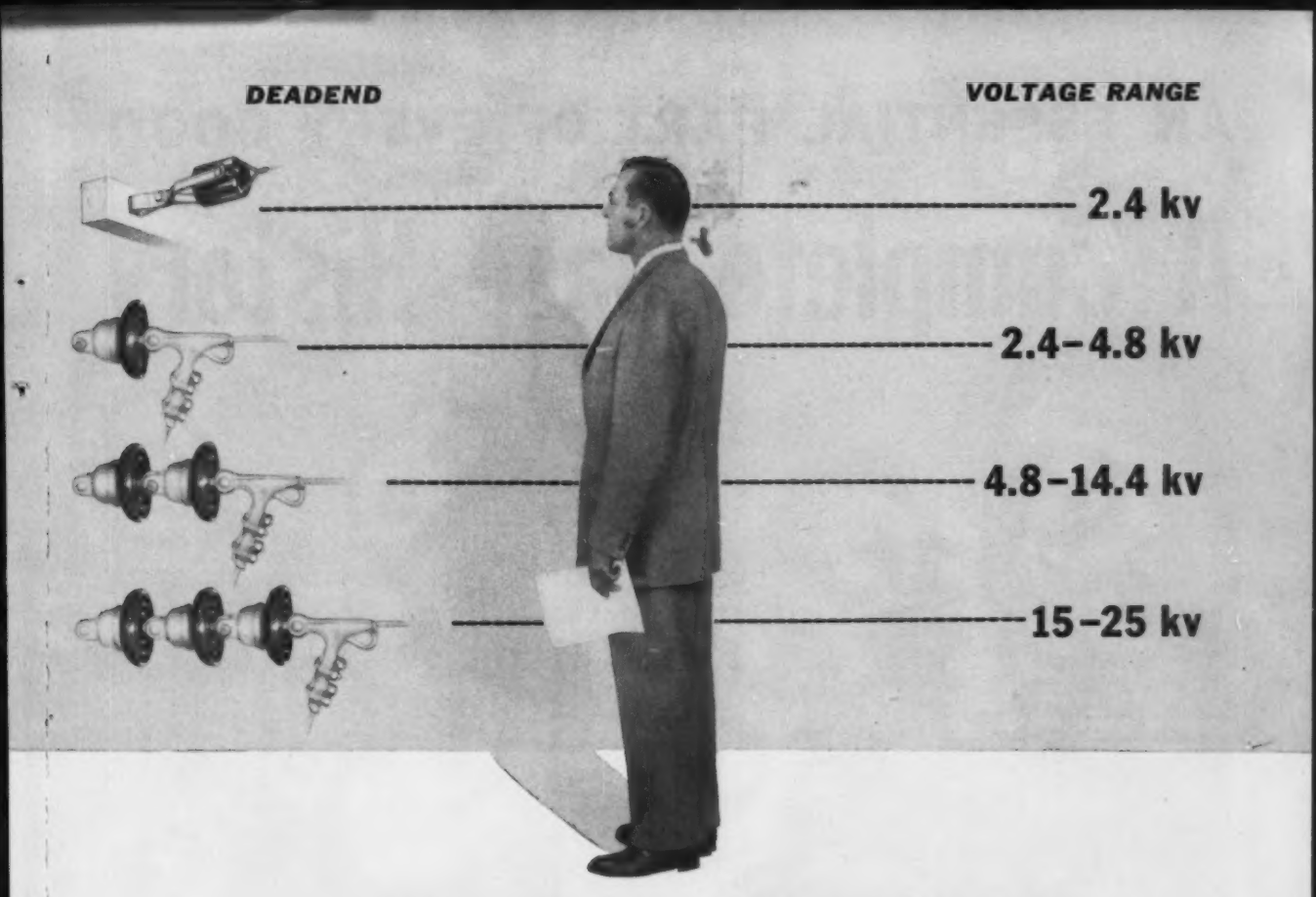
ASA models available – to specification C39.2–1953.

Write for complete data on Bristol 1-, 2-, or 3-pen recording voltmeters. The Bristol Company, 116 Bristol Road, Waterbury 20, Conn.

B-10

BRISTOL TRAIL-BLAZERS IN PROCESS AUTOMATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS



Which Deadend Will Fit Your Distribution System Tomorrow?

BUILD IT NOW AND BE READY FOR HIGHER VOLTAGES OF THE FUTURE

Remember when all that was needed for insulating a distribution deadend was a simple x-strain insulator, a Johnny-ball? People were saying that distribution voltage couldn't possibly ever go over four kv. After all, customers weren't going to need *that many* light bulbs.

You know what's happened. They are using "that many" light bulbs, plus dozens of other "Live Better . . . Electrically" items. Voltage in the 12-kv range is almost as popular for primary distribution as two kv once was. Already, many companies are thinking about 22 kv. Some forecasters say that they may eventually settle for even higher voltages.

You probably already know how high you want to go with distribution voltage. Our only suggestion is that you take a good look and make sure it's high enough. As you rebuild deadends and build new primary distribution lines, install enough insulation to fit your ultimate plans. At strain positions it will save a lot of future labor expense, and give you assurance that the line is insulated for tomorrow's voltages.

The insulators to use? Graybar has them, and they're made by Ohio Brass.

OHIO BRASS COMPANY, MANSFIELD, OHIO

LIVE BETTER ELECTRICALLY

Ohio Brass

Distributed by Graybar Electric Company

487-H

AN ESSENTIAL PART OF EVERY GOOD

A Complete Case History

Source, type and lot of all raw materials are readily identifiable from records for each serial number.

Responsibility for every factory operation is definitely fixed and a matter of record.

4874-H

CAPACITOR . . .

for Every Serial Number

Give us the serial number of a Varex capacitor, and we can quickly tell you its life story . . . the source, type, and lot of raw materials . . . the day it was made . . . the crew that made it . . . the processing record, including a log of the evacuation procedure . . . the final factory tests and the results.

All this information has been compiled on a data processing card for each capacitor.

You may be interested in knowing how such a system results in a better capacitor for you. For one thing, it provides a complete master check on every production detail, helps immensely in operating a successful quality control program.

It also fixes responsibility. Every supplier of material, every O-B employee knows that what he contributes to a Varex unit is a matter of record.

It also provides a sound, precise fund of knowledge for making product improvements in an orderly way. If we change a material or process, even slightly, we can pinpoint the effect immediately and evaluate the results during the factory testing program.

When it's necessary to correlate factory procedure with field performance, it's much easier when we have complete case histories on each capacitor.

At the moment we sincerely believe you're getting the best capacitor available when you buy Varex. But we know there is always room for improvement, in any product. That's why we're doing everything possible, and individual product identity is just one phase, to make sure these improvements come as fast as possible!

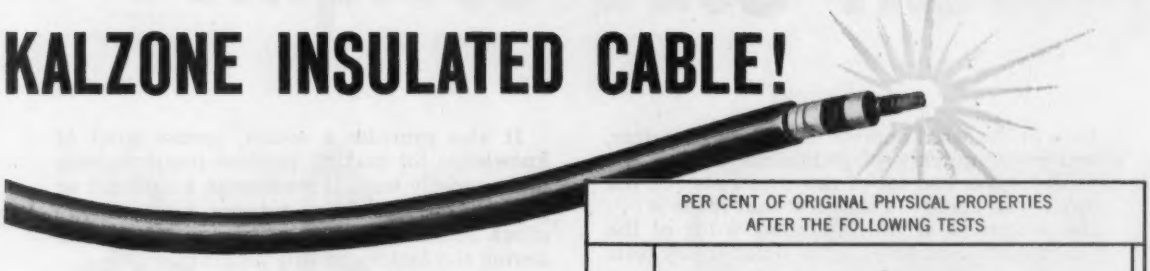
OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

Evacuation procedure is logged carefully; log becomes part of a permanent record.

Final electrical tests build fund of fundamental knowledge from which we can proceed to improve the product.

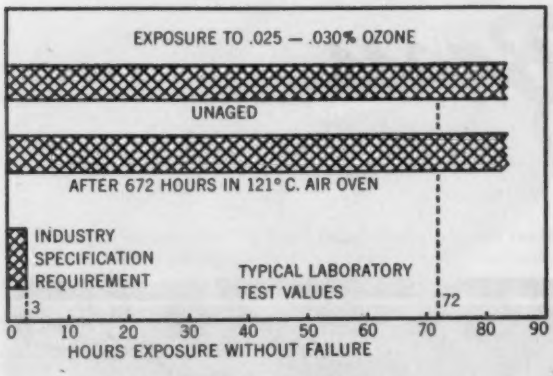
10 TIMES MORE INSULATION RESISTANCE WITH KAISER ALUMINUM HIGH VOLTAGE KALZONE INSULATED CABLE!



A year-long analysis of 393 full-length reels of Kaiser Aluminum Kalzone insulated cable showed that more than 93% of the lengths tested exceeded an insulation resistance constant "K" of 100,000 . . . ten times greater than current IPCEA requirements of 10,000!

More than 5% of the balance tested exceeded a 50,000 "K," and ¾ of 1% fell between 25,000 and 50,000.

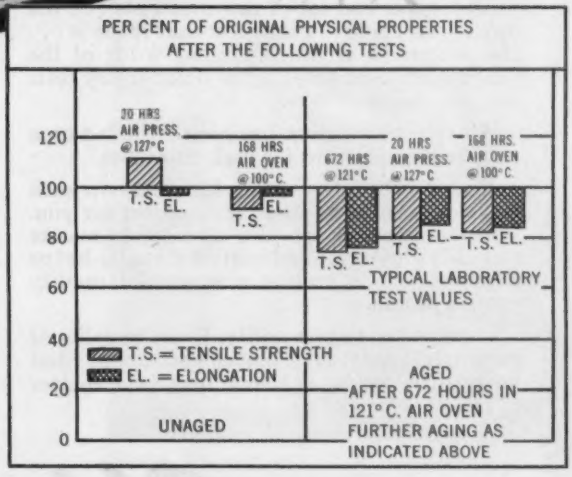
Laboratory tests prove Kalzone provides best protection against ozone, heat, moisture


EXPOSURE TO .025 — .030% OZONE
UNAGED
AFTER 672 HOURS IN 121° C. AIR OVEN
INDUSTRY SPECIFICATION REQUIREMENT
TYPICAL LABORATORY TEST VALUES
3
72
0 10 20 30 40 50 60 70 80 90
HOURS EXPOSURE WITHOUT FAILURE

OZONE RESISTANCE

Unaged—Withstands more than 72 hours in .025–.030% ozone without failure.

Aged—Still withstands more than 72 hours in .025–.030% ozone without failure after 672 hours in a 121° C. Air Oven.



HEAT RESISTANCE

Unaged—Practically unaffected by Air Pressure or Air Oven Tests.

Aged—Actually improves in per cent of original tensile strength and elongation in Air Pressure and Air Oven Tests, after 672 hours in 121° C. Air Oven.

MOISTURE RESISTANCE

MECHANICAL

Unaged—Less than 5 milligrams absorption in standard Gravimetric 7-day Test. (IPCEA, 15 mgms.)

Aged—After 672 hours in a 121° C. Air Oven, less than 7 milligrams absorption.

ELECTRICAL

Unaged—Less than 2% increase in Capacity in 1–14 day EM-60 Test. (IPCEA, 5%.)

Aged—After 672 hours in a 121° C. Air Oven, less than ½ of 1% increase in capacity in 1–14 day EM-60 Test.

Kaiser Aluminum Kalzone insulated high voltage cable is laboratory tested and quality controlled during actual production to assure *proved quality* with every reel. Get full details on this low cost, lightweight aluminum power cable now. Contact the Kaiser Aluminum sales office listed in your telephone directory.

Kaiser Aluminum & Chemical Sales, Inc., 919 N. Michigan Avenue, Chicago 11, Illinois.

KAISER ALUMINUM

IF IT CARRIES CURRENT, K&W CARRIES IT!

BERGEN GETS 8 LJUNGSTROMS®
...AND SOME REMARKABLE CUSTOMER SERVICE

Public Service's new Bergen Generating Station will be served by 8 large, horizontal Ljungstroms. Almost as important . . . the Ljungstroms will be serviced *throughout* their life by Air Preheater.

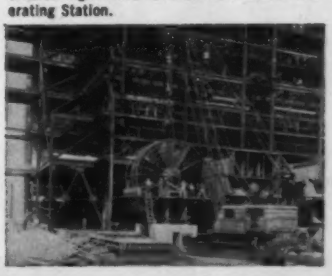
What's special about this customer service? For one thing, it's the considerable knowledge and talents of Air Preheater's engineers. They have been involved in nearly every conceivable type of boiler/preheater problem. They've seen how these problems can be handled. And they can put this experience to work for operators of Ljungstrom air preheaters.

Your Air Preheater engineer also makes regular calls to check the operation of every Ljungstrom – for as long as it's in service. (This now includes installations dating back to 1923.)

So, when you select a Ljungstrom, you're never entirely on your own. You *continue* to be the responsibility of a competent Ljungstrom engineer and benefit from his experience and knowledge. Maybe that's why 9 out of 10 preheaters sold are Ljungstroms.

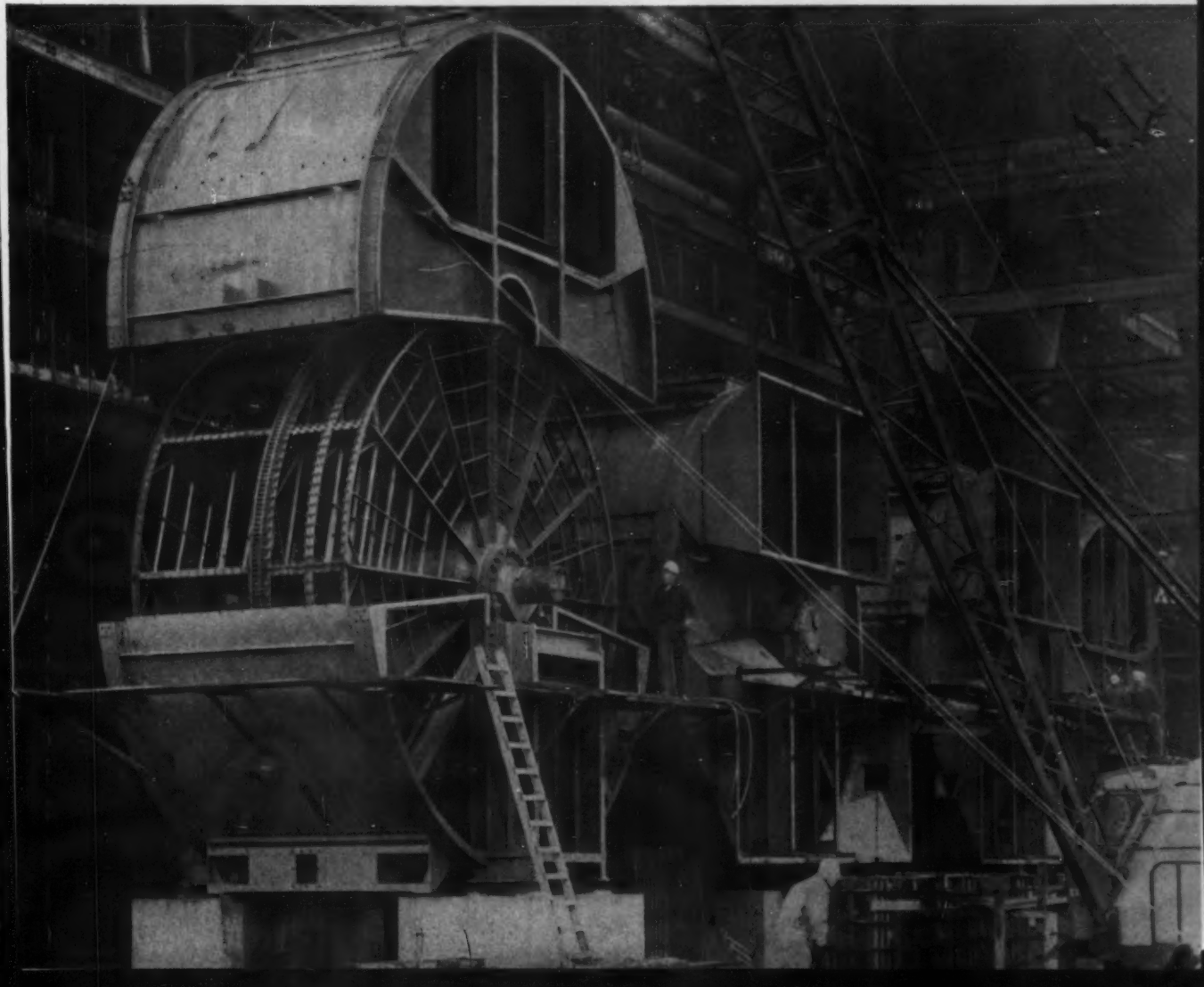
Thirty-five tons of Ljungstrom rotor being lowered into place at the new Bergen Generating Station at Ridgefield, N. J. (When the heating elements are installed the rotor will weigh 150 tons.) This is one of eight preheaters being installed by Public Service Electric and Gas Co. to serve two boilers – each evaporating 1,900,000 lbs of steam/hr. The first boiler is to be fired early next year. Anticipated preheater outlet temperature is about 275 F.

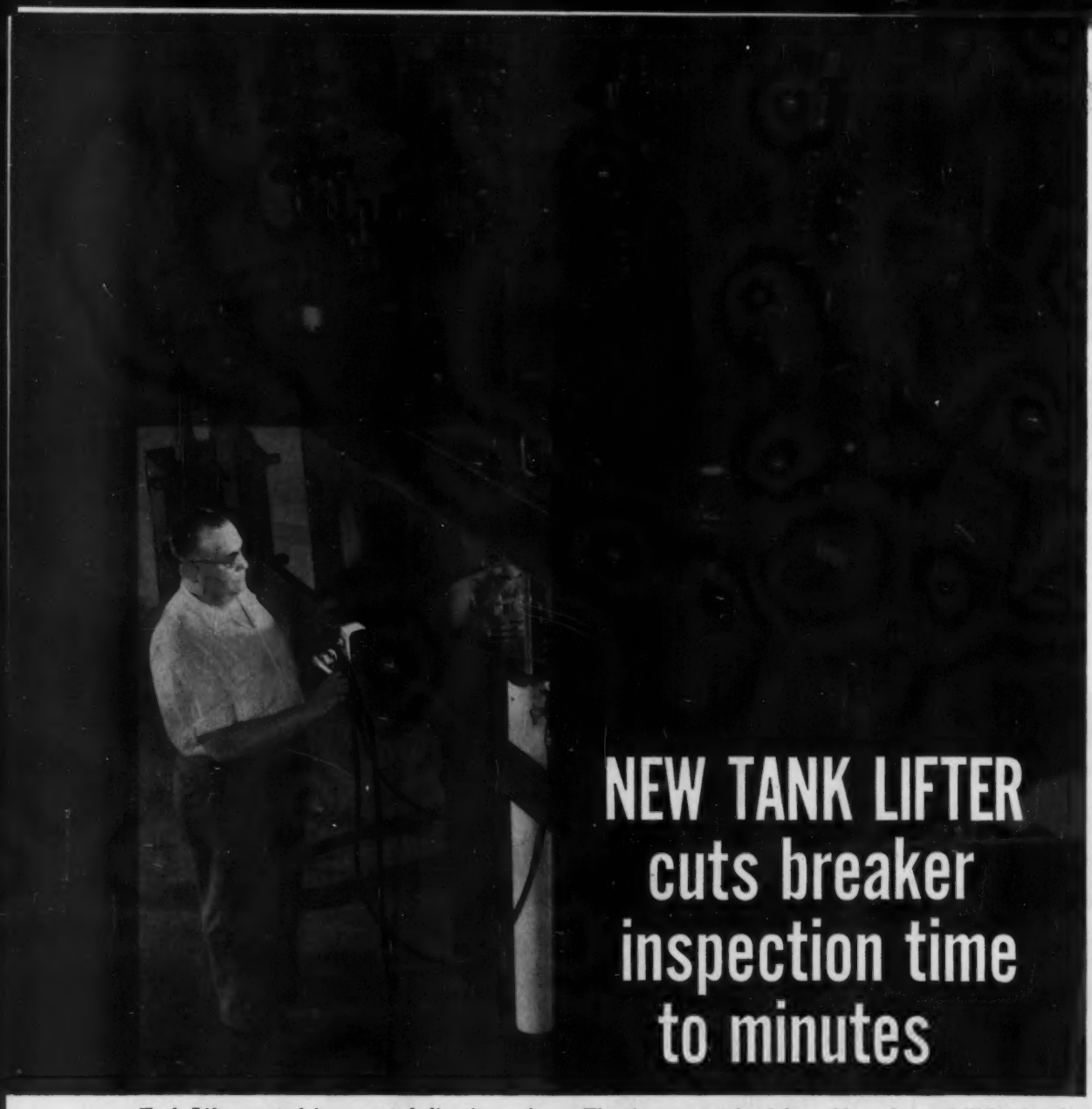
Public Service is one of the first Northern utilities to use large-size horizontal preheaters. They have nine such horizontals in operation at their Linden Generating Station and have ordered eight more for their new Mercer Generating Station.



THE AIR PREHEATER CORPORATION

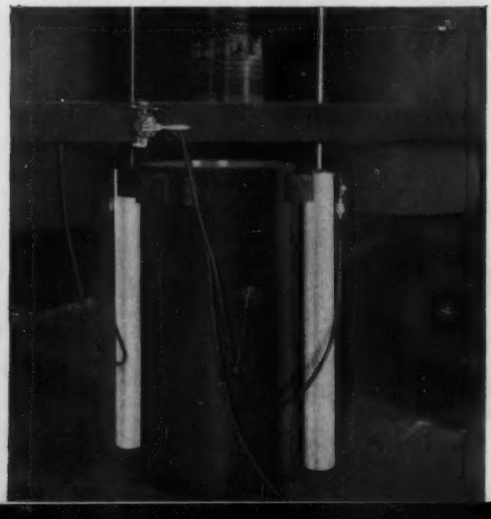
60 East 42nd Street, New York 17, N. Y.





NEW TANK LIFTER cuts breaker inspection time to minutes

Tank Lifter control is connected directly to the tank of the breaker's air supply through flexible, high-strength rubber tubing. Lightweight control, tubing and cylinders can be easily stored when not in use or kept on the maintenance crew's truck.



The time-consuming labor of lowering and lifting breaker tanks for inspection and maintenance can be practically eliminated with the new Westinghouse Pneumatic Tank Lifter. Operated from the breaker mechanism's air supply, this device will, in approximately two minutes, raise or lower a full tank of oil. Grids and contacts can be inspected with minimum delay.

The pair of pneumatic cylinders can be easily moved from tank to tank. A single operating valve and a built-in, self-leveling device assure simple, trouble-free operation with a minimum of effort.

Call your Westinghouse Sales Engineer today for further information about this new circuit breaker device designed to better serve your needs. Or, write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

J-60957

YOU CAN BE SURE...IF IT'S **Westinghouse**

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

RCA RADIO . . . FIRST CHOICE OF THE LEADERS

New Convenience and Control in Communications for Utilities . . .

RCA Mobile Radio with PERSONALFONE!

Here's the way to gain top efficiency in handling your trucks and your men: use dependable RCA 2-Way "Carfone" Radio in mobile equipment, and RCA Personalfone "Belt" Radio on linemen or construction workers *away from vehicles* . . . for instant contact on the job!

RCA "Carfone" Radio is available for all frequencies and assures quality that only the leader in radio and electronics can offer . . . split or wide channel equipment, featuring new "Minitrol" combination microphone-control-speaker efficiency for desk stations, "Red-Head" clear-talking mobile microphone.

New RCA Transistorized "Personalfone" miniature Radio provides two-way service, mounts in two pouches on lineman's belt, has excellent selectivity and stability.

Advanced engineering means greatest satisfaction, lowest maintenance. Expert service by RCA's own Communications technicians.

Find out about this modern communications equipment today! Use coupon.

RCA PERSONALFONE FM "BELT" RADIO

RCA Tmk(s) ®

RADIO CORPORATION of AMERICA

COMMUNICATIONS PRODUCTS

CAMDEN, N.J.

Radio Corporation of America
Communications Products
Dept. NC-45, Building 15-1, Camden, N.J.
In Canada: RCA VICTOR Company Limited, Montreal

☐ Please send me FREE booklets on RCA Communications Equipment for use in the Utilities.

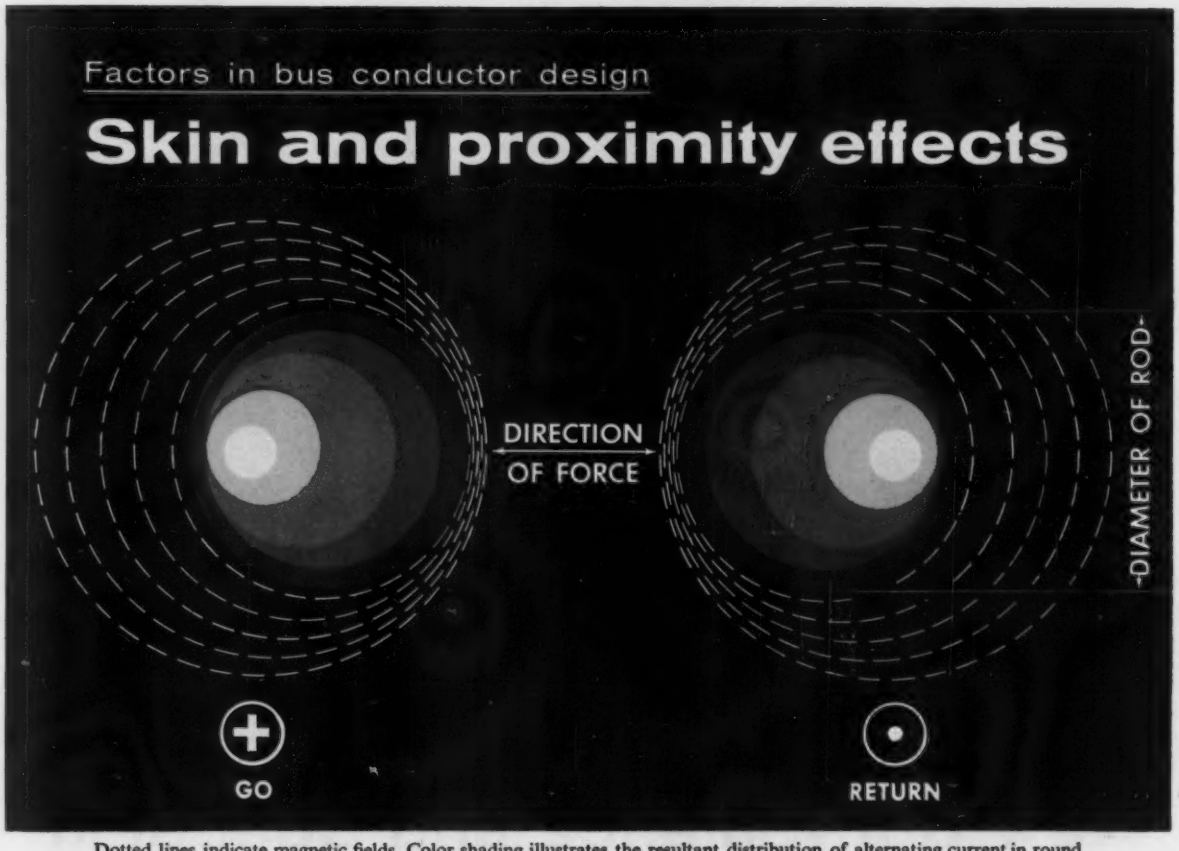
NAME _____ TITLE _____
PLEASE PRINT

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

☐ Have RCA Communications Specialist contact me.



Dotted lines indicate magnetic fields. Color shading illustrates the resultant distribution of alternating current in round rod conductors. Mechanical force is developed as the centers of current try to move into the centers of their magnetic fields.

Low skin-effect ratio favors tubular shape

Skin effect becomes increasingly important in the medium and larger sizes of bus conductors carrying alternating current. It is the basic reason for using tubular conductors, quite apart from the structural advantages which they also possess. Tubular shapes (round or square) and paired channels have low skin-effect ratios, i.e., low effective resistance to alternating current.

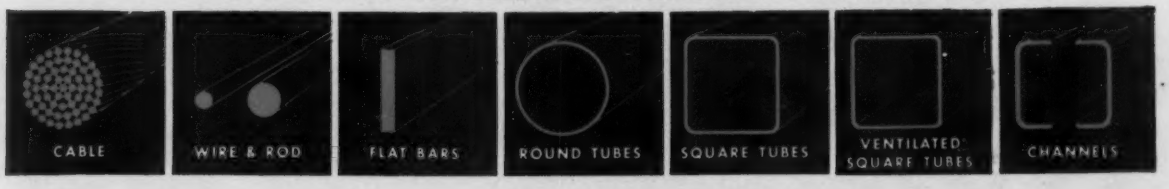
Skin effect is, essentially, the crowding of the main alternating current flowing in a conductor toward the outside surface by a contrary flow induced in the center of a solid conductor, a cable, or in the inner annular area of a tubular conductor by the constantly varying magnetic flux surrounding it.

Proximity effect is uneven distribution of an electrical current over the cross section of a conductor due to distortion of the surrounding magnetic field by the field or fields generated by current in neighboring conductors. The practical result of "proximity" is an increase in the apparent resistances of the conductors affected. Mechanical forces also are generated.

Field and current distribution problems are two of the many which complicate bus design. The Technical Department of The American Brass Company is always available to engineers for consultation in the selection of Bus Conductors for specific needs. See your Anaconda representative, or address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA® COPPER CONDUCTORS

THERE'S AN ANACONDA ELECTRICAL CONDUCTOR FOR EVERY NEED

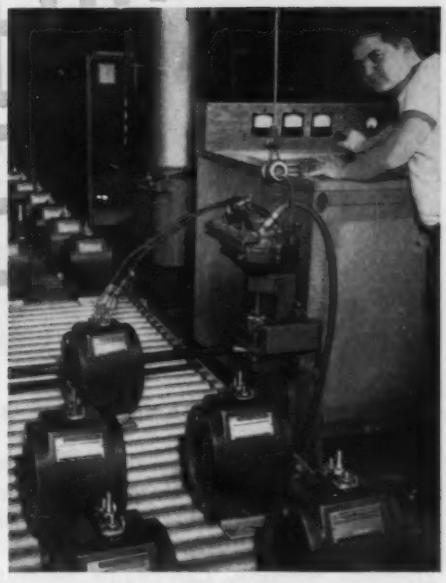


ALLIS-CHALMERS

ALLIS-CHALMERS

ALLIS-CHALMERS

Plan to stay ahead... MODERNIZE!



Now Available . . .

18 types of cast epoxy resin instrument transformers

To meet industry's growing demand for these superior quality instrument transformers, Allis-Chalmers has instituted a program of developing a number of new types for various applications -- and has more than doubled previous production capacity.

No Maintenance — Easily Installed

Epoxy resin, virtually a miracle material, gives transformers complete protection—both electrical and mechanical—either outdoors or indoors.

Allis-Chalmers epoxy resin transformers:

1. Have excellent dielectric properties.
2. Can withstand wide temperature variations and severe mechanical shocks.
3. Are maintenance free . . . require no painting, resist solvents.
4. Can be installed in any position — quickly, easily.

Your A-C man will give you the complete story, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Types of epoxy resin cast transformers available

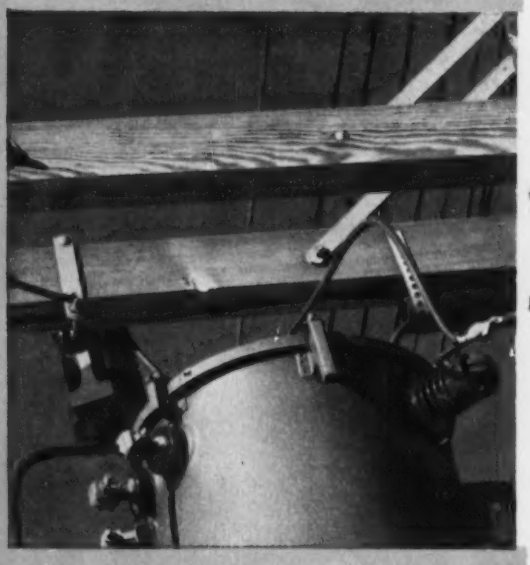
Type	INDOOR	OUTDOOR	INSULATION CLASS	CURRENT RATINGS (AMPERES) 15-5	15-5	25-5	40-5	50-5	75-5	100-5	150-5	200-5	300-5	400-5	600-5	800-5	1000-5	1200-5	1500-5	2000-5	3000-5	4000-5
BKM	x	x	600															x	x	x	x	x
LM	x		600														x					
MM	x	x	600										x		x							
TWM	x	x	600										x		x	x	x					
BKIM	x		5000															x	x	x	x	x
BKAW1M	x	x	5000															x	x	x	x	x
BKWD1M	x	x	5000															x	x	x	x	x
BKM PLUS ELT	x	x	5000															x	x	x	x	x
LBM 45 KV IMPULSE	x		5000	x	x	x	x	x	x	x	x	x	x	x	x	x						
LDM 45 KV IMPULSE	x		5000	x	x	x	x	x	x	x	x	x	x	x	x	x						
TWM PLUS ELT	x	x	5000										x		x	x	x					
BKI2M	x		8700															x	x	x	x	x
BKAW2M	x	x	8700															x	x	x	x	x
BKWD2M	x	x	8700															x	x	x	x	x
BKI3M	x		15000															x	x	x	x	x
BKAW3M	x	x	15000															x	x	x	x	x
BKWD3M	x	x	15000															x	x	x	x	x
K3M	x		15000	x	x	x	x	x	x	x	x	x	x	x	x	x						

ALLIS-CHALMERS

A-5814

HERE'S HOW TO CUT OPERATING COSTS

Install Transformers That Stay Young, Live Longer



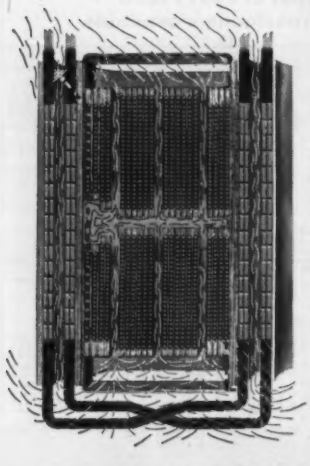
WHAT SHORTENS TRANSFORMER LIFE?

Heat and moisture do more to shorten transformer life than anything else. Once moisture gets into the oil, sludge forms—oil circulation slows down—winding temperatures increase—and insulation gradually weakens. This begins the aging process.

WHAT KEEPS TRANSFORMERS YOUNG? . . .

. . . Obviously, a means of controlling moisture and heat. That's why Kuhlman transformers are thoroughly dried inside and sealed air-tight and moisture-proof outside. Also, why generous ducts are spaced all through the windings to carry off excess heat and assure cool operation.

As an operator, you can get the most out of this built-in life by limiting excessive overloading—working with care and cleanliness around open transformers—and checking the condition of the oil occasionally.



Free movement of oil through the windings carries off heat, eliminates damaging hot spots, keeps the transformer young longer.

DOES CONDITION OF OIL AFFECT TRANSFORMER LIFE?

Perma-Kuhl Oil, used in Kuhlman transformers, is the finest coolant and insulator you can buy. Minimum care keeps it clean and clear.

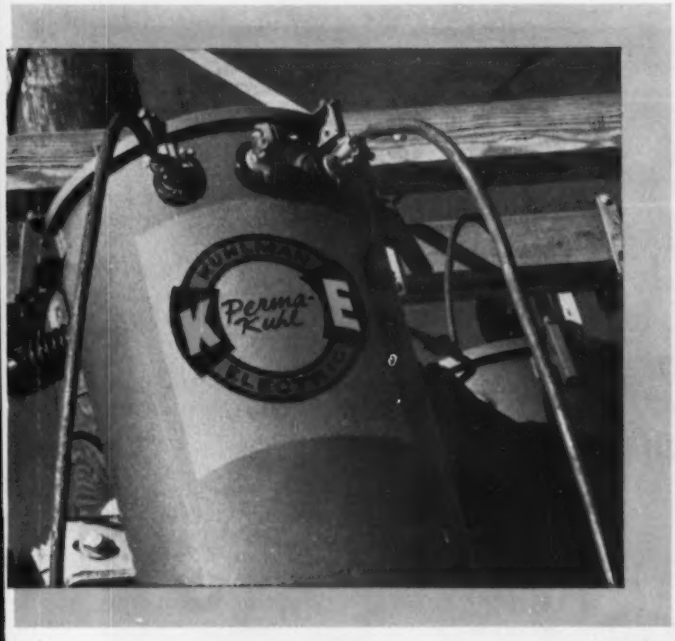
The best oil, however, will oxidize and form sludge under abnormal operating conditions. Sludge impedes oil circulation, weakens insulation and, finally, will corrode steel. Routine inspections can avoid these harmful effects.*

The dielectric strength of oil is accurately determined by laboratory testing.

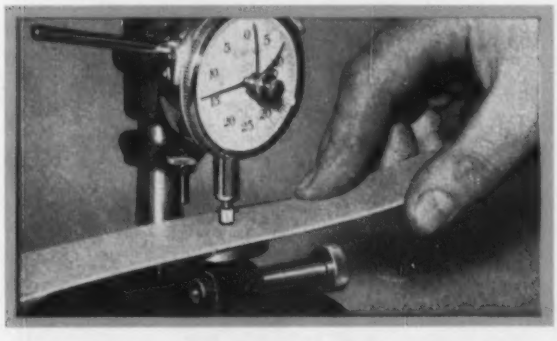
HOW MANUFACTURING METHODS INCREASE LIFE

Design alone can't guarantee long life. It takes careful manufacturing to build endurance into a transformer.

**For facts on transformer oil behavior, write for "Kuhlman Kurrents," Volume 32, Number 3.*



Special emphasis is put on manufacturing controls at Kuhlman. Connections are tight; winding tensions are held within close ranges; core steel is processed with great care. Countless other rigid standards are observed.

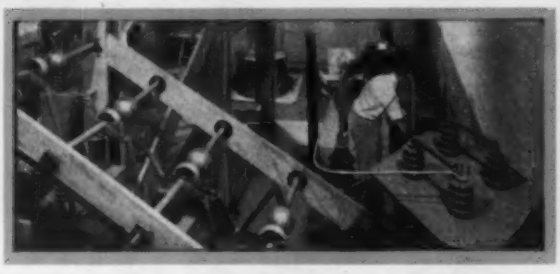


Painstaking checking of insulating material assures quality and accurate dimensions for long service.

The men who build Kuhlman transformers under these manufacturing controls are long in the business, and their skills lengthen the lives of the transformers they build.

HOW IMPULSE TESTING ASSURES LONG LIFE

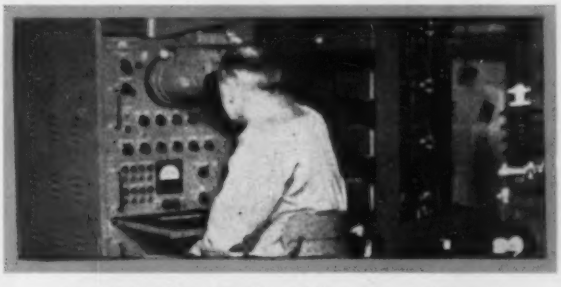
Every Kuhlman design approved for manufacturing and every pole-type transformer approved for shipment must pass the "Impulse Test." This test—which subjects the transformer and all its components to a simulated surge of lightning—gives positive proof of transformer quality.



Design impulse tests in the laboratory establish the quality and the lifetime impulse level of the transformer.

As a design test, it establishes the basic impulse strength of the transformer. This, at Kuhlman, is in excess of NEMA requirements to provide added quality and protection for longer, more useful life.

As a production test, it assures each finished transformer coming off the assembly line is free of defects, has design quality, and is ready for long-term, trouble-free service. Any hidden weakness that might cause trouble—no matter how minor—is quickly detected by these rigorous final tests.



Production line impulse testing assures that each unit coming off the production line meets Kuhlman standards.

Today the big difference in transformers is quality

Whether your job is specifying, ordering, or keeping transformers in service, you'll find Kuhlman quality means longer life, better service, at lower cost.

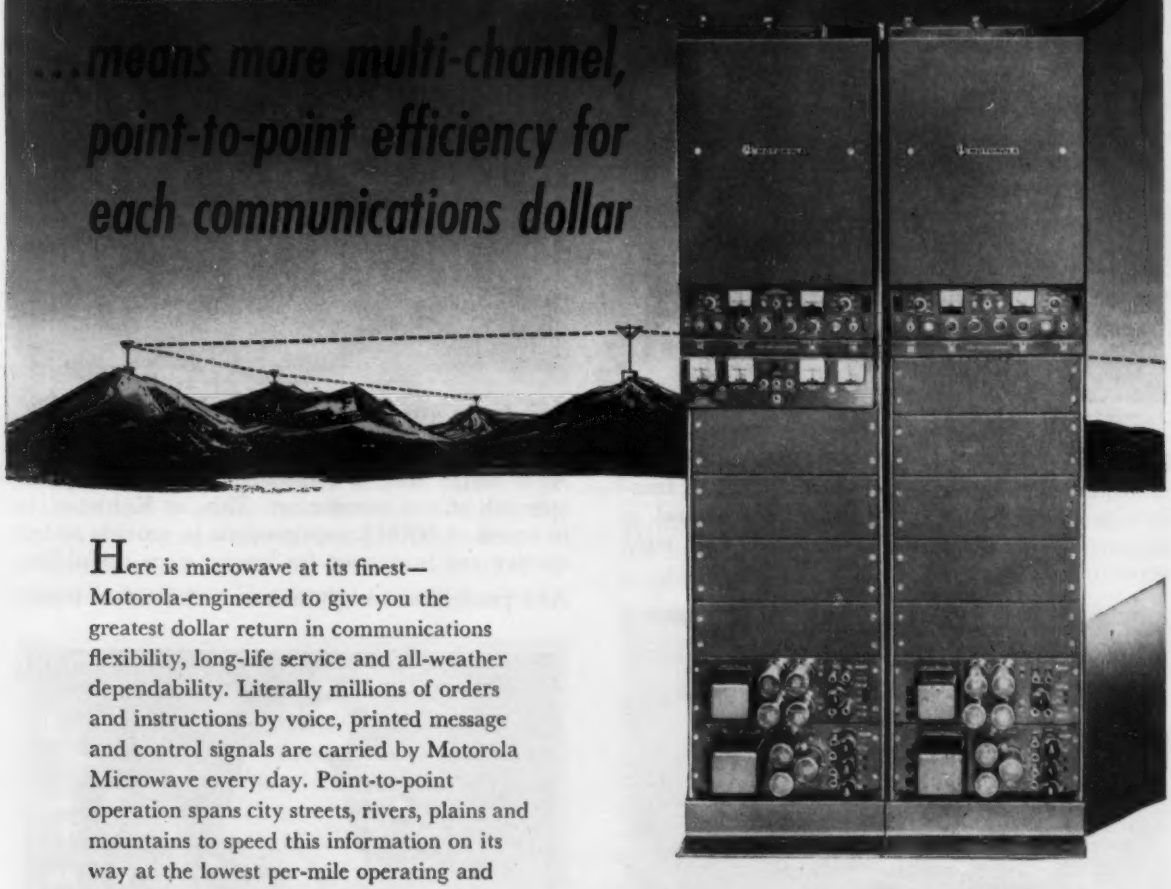
KUHLMAN DISTRIBUTION TRANSFORMERS

KUHLMAN ELECTRIC COMPANY General Offices: Birmingham, Michigan

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA

MR-20 MOTOROLA MICROWAVE

...means more multi-channel, point-to-point efficiency for each communications dollar



Here is microwave at its finest—Motorola-engineered to give you the greatest dollar return in communications flexibility, long-life service and all-weather dependability. Literally millions of orders and instructions by voice, printed message and control signals are carried by Motorola Microwave every day. Point-to-point operation spans city streets, rivers, plains and mountains to speed this information on its way at the lowest per-mile operating and maintenance costs.

Simple, "building-block" components—Motorola MR-20 and associated multiplex equipment—can be fitted to your communication need to provide for any combination of voice, control and data transmission, including 2-way radio operation. Let Motorola Microwave bring the full efficiency and the money-saving opportunities of just-right communications to your operations.

Send for illustrated Brochure 1188.

MR-20 Microwave RF equipment . . . even more simple and reliable for maximum dollar value

- **Automatic Switchover-Switchback** . . . provision available for bi-lateral switching where desired.
- **"Hot" Standby** . . . enables switchover to pre-heated unit in less than one second.
- **Simplified Waveguide** . . . allows additional RF channels to be multiplexed to common antenna.
- **Frequency Diversity** . . . provides maximum circuit continuity in 5925-6425 MC band.
- **Plus outstanding Motorola developments for 6000 MC operation** . . . explained in detail in Brochure 1188.

MOTOROLA MICROWAVE

Motorola Communications & Electronics, Inc., A Subsidiary of Motorola Inc., 4501 Augusta Blvd., Chicago 51, Illinois

NEW

JOINS 26% FASTER

Because there are no separate couplings to assemble on the job, Orangeburg's new CA Conduit lays faster—costs less to install. In addition, there are no coupling cartons to handle, transport or store.

Orangeburg's new CA Conduit comes, at *no extra cost*, with a factory-attached coupling at one end and a standard 2° male taper at the other end. To join—CA's long, lightweight lengths are placed end to end—hammered home in a simple, one-step operation. Actual installations *prove* Orangeburg's new CA Conduit joins up to 26% faster!

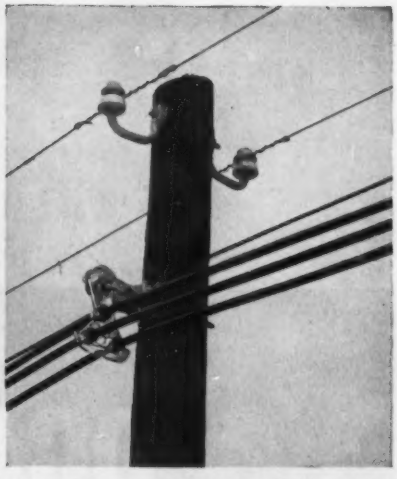
What's more, because the attached coupling is *flush* with the outside diameter of the conduit, new CA Conduit is easy to handle and store in neat, even stacks. And with the new flush coupling there's no need to "stagger" conduit joints in the trench. That means less cutting and tooling time.

New CA Conduit—like the millions of feet of Orangeburg Fibre Conduit in use since 1893—has self-sealing joints and impermeable walls that make it absolutely watertight. Its smooth 100% fibre raceway adds years to cable life.

Specify new CA Conduit on your next job. This addition to Orangeburg's line is available in 2", 3", 4", 4½" and 5" sizes. Orangeburg's Standard and Nocrete Conduit with separate sleeve couplings are available as always. Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y. and Newark, Calif.

Orangeburg Fibre Conduit is distributed by Graybar Electric Co. and General Electric Supply Co. with branches and stocks in principal cities.

New Roeclamp* with Roeplastic® Cable Costs 60% Less than Self-Supporting Cables, Minimizes Tree Problems, Installs with Ease, Looks Better!



New Roebling ROEPLASTIC Cable with ROECLAMP requires only one foot of clearance through trees! Note improved, compact appearance. No crossarms are needed.

Designed for 5kv systems (2400/4160Y and 4800 v delta) and 8kv systems (4800/8320Y and 7200 v delta), the Roebling Aerial Spaced Cable actually costs 60% less than conventional self-supporting cables. It provides a neat, compact appearance, improved voltage regulation, higher current-carrying capacity, and positive phase identification.

Up to three conductors can be carried by ROECLAMPS, which are suspended from a strong messenger. The messenger also provides protection against lightning and falling limbs.

Aluminum conductors come in 17 standard sizes and strand constructions, and are made with a greater number of finer strands for extra flexibility. Many types of extruded insulations are available, depending upon proposed usage. ROECLAMPS come complete with grommets to fit cables and messenger you order.

Ask your Roebling representative to show you the remarkable new ROECLAMP. He'll tell you more, too, about the unusual savings and improvements you can effect, or write Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

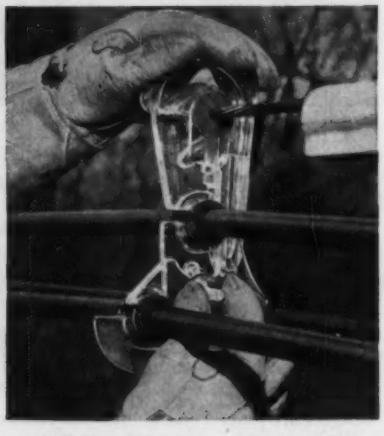
ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

Roeclamp has unit construction... installs in seconds—without tools!

One motion and ROECLAMP is on messenger and ready to receive conductors. Phase changes and repairs do not necessitate removal of clamp. ROECLAMP comes complete with grommets to fit messenger and conductors you order.

Note how easily conductors drop into place. Installation is measured in seconds, even with "boxing gloves" on. ROECLAMP is Plexiglas†, tests to over 1000-lb. breaking strength, offers outstanding weather resistance, best possible electrical properties.



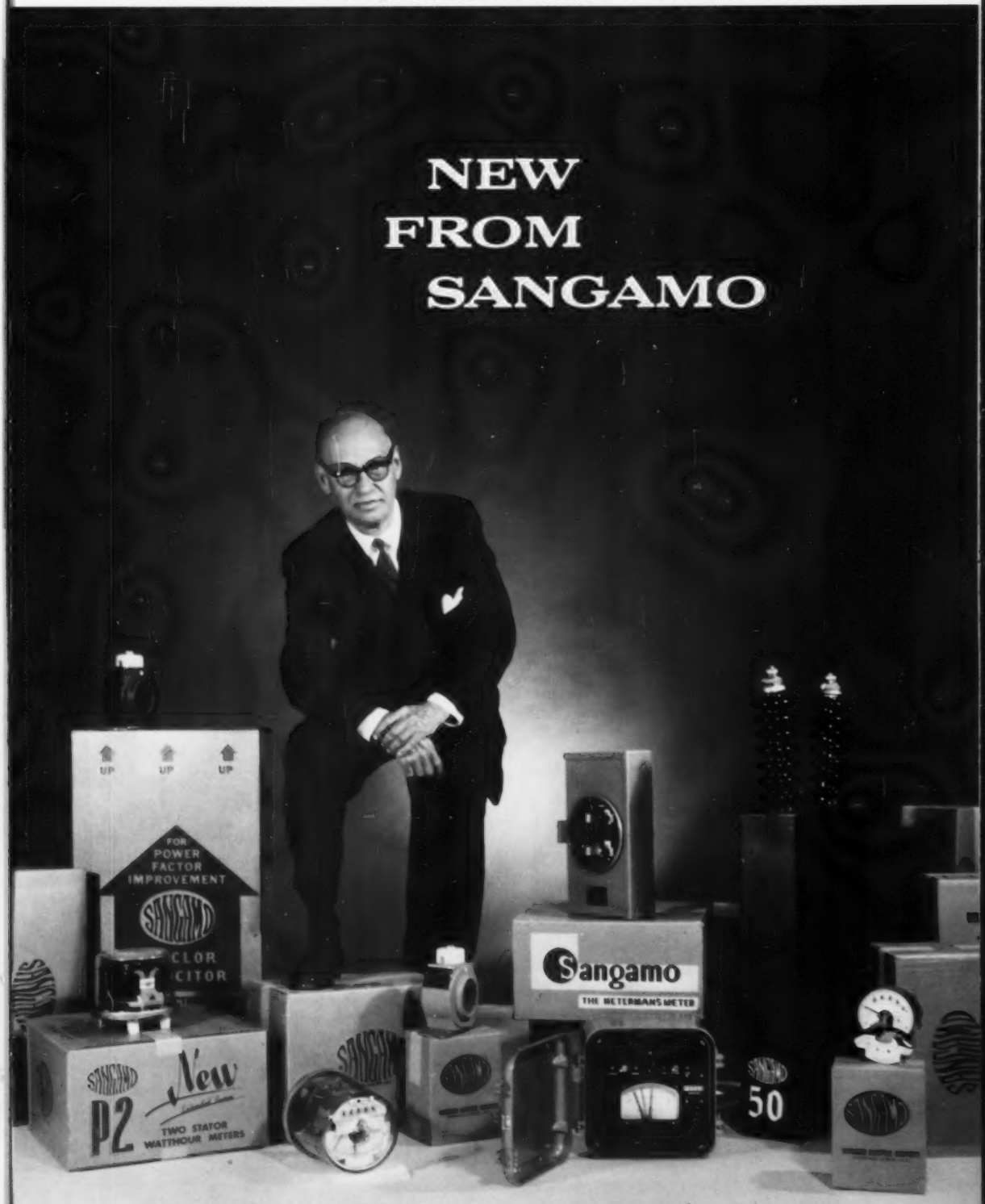
35 ROECLAMPS are required every 1000 feet. Installation is completed by hand-tightening of nut. Not even a screw driver is required!

*Pat. pending
†Reg. T.M.—Rohm & Haas Co.

Another year
of product
development

FOR THE ELECTRIC UTILITY INDUSTRY:

NEW FROM SANGAMO

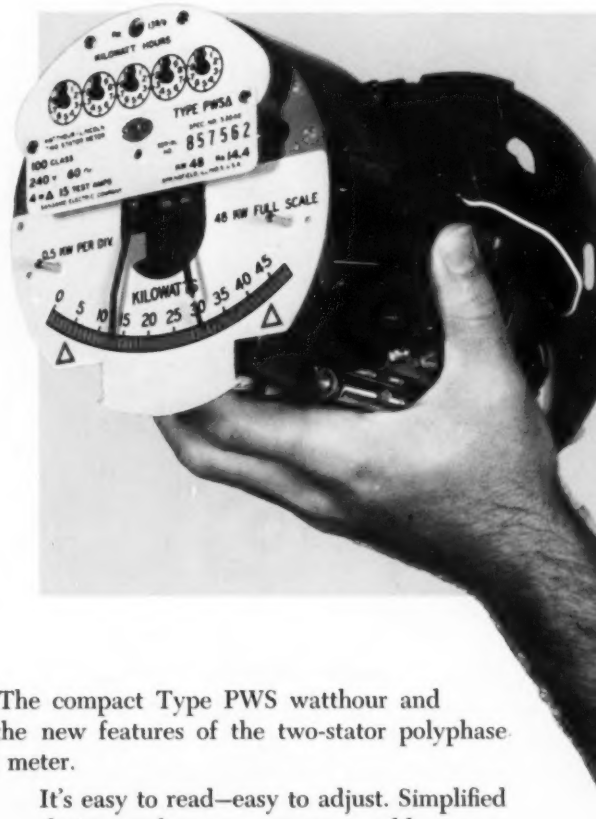


ACTIVELY MEETING THE INDUSTRY'S NEEDS...
for increasing the utilities saleable power
and for better methods of measurement

DEVELOPED TO MEET YOUR NEEDS:

New Demand Meters

FOR CONTINUED LEADERSHIP IN DEMAND METERING



THERMAL DEMAND The compact Type PWS watthour and Lincoln demand meter combines the new features of the two-stator polyphase meter and the Lincoln watt demand meter.

It's easy to read—easy to adjust. Simplified design makes components readily accessible.

Where future load growth is anticipated, capacity of the demand element can be doubled by changing two link connections and changing the demand scales (24/48 kw or 48/96 kw).

MECHANICAL DEMAND

Sangamo's new Type D mechanical demand register, when installed on any of the Sangamo Type P2 extended range watthour meters, accurately measures kw demand on all polyphase loads.

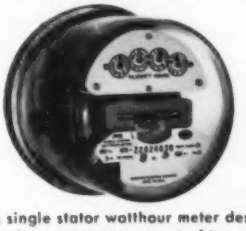
Universal and standard Type D registers were designed to give greater disk visibility, better service accuracy, time interval indication, and simple disengagement of timing motor for register checking.

New Multi-Stator Meters

FOR EXTENDED RANGE ON ALL POLYPHASE SERVICES

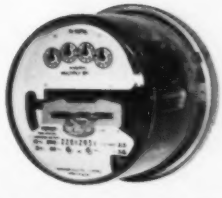
Sangamo has designed a complete line of Type P polyphase watthour meters to give greater versatility of application through extended range . . . easier adjustment and maintenance . . . high insulation level . . . savings in height and cover replacement . . . and proven economy through *slow speed.*

and new meters DESIGNED FOR SPECIAL METERING PROBLEMS



A single stator watthour meter designed for low cost measurement of two phases of a four-wire, three phase system.

A kvar hour meter to measure reactive energy (and demand) without the use of external phase-shifting transformers.



A kva hour meter to measure apparent energy (and demand) without the use of external phase-shifting transformers.

THE NEWEST ADVANCES IN 600 V CLASS CURRENT TRANSFORMERS

200, 400, 600, 800 AMPERES WITH DUAL RANGE 200/400 AMP FEATURE

Sangamo Type BH (Big Hole) Transformers have more cable space, more installation room, easier cable insertion—and a unique two range option to reduce transformer changeouts.

COLOR CODED FOR QUICK IDENTIFICATION

Transformers are molded in an epoxy resin of standard resistor colors to indicate ampere ratings.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

DEVELOPED TO MEET YOUR NEEDS:

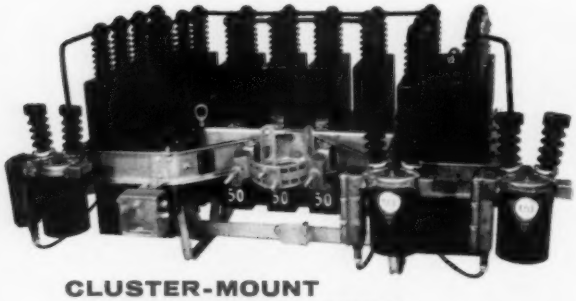
New capacitors, equip

TO INCREASE THE U

SECOVAR
SECONDARY CAPACITORS

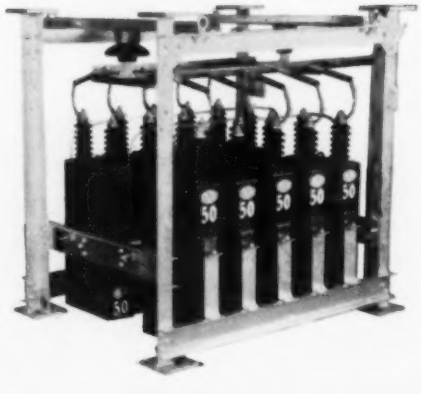
These 240 volt capacitors are an exclusive Sangamo development. Installed at the customer's service, Secovars give maximum system benefits all down the line, and give the advantages of low first cost—quick and easy installation off the pole.

Keenly aware of your problems of reducing the amount of wattless power and improving voltage on your system, Sangamo's developments this year make its line of capacitors and controls the most extensive in the industry . . . your first source of supply for all capacitor needs.



CLUSTER-MOUNT
AUTOVAR EQUIPMENTS

Sangamo engineered, pre-wired cluster-mount equipments give you a fast, easy, economical capacitor installation and better weight distribution on the pole.



OPEN-TYPE EQUIPMENTS

These cost-cutting singlephase or polyphase stacking units have been designed for combinations to give any desired kvar for all primary voltages.

LIVE BETTER ELECTRICALLY

SANGAMO ELECTRIC COMPANY

uipments, and controls

E UTILITIES SALEABLE POWER

15 KV CAPACITORS

These capacitors were developed for floating Y applications and are capable of resisting voltage surges up to 95 kv.

HOUSED CAPACITOR EQUIPMENTS

Combining safety and neat appearance, these housed equipments provide a compact installation with features including automatic control and circuit breakers.

SUBMERSIBLE SECONDARY EQUIPMENTS

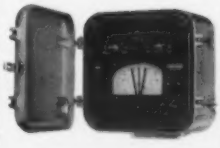
Developed for low voltage underground network installations, these factory-assembled equipments are completely submersible.

SUBMERSIBLE PRIMARY EQUIPMENTS

Sangamo designed these completely sealed primary equipments for underground installation in locations where overhead pole space is not available.

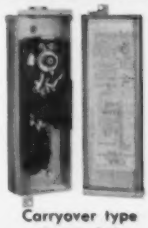
NEW CONTROL ADDITIONS TO THE MOST COMPLETE LINE IN THE INDUSTRY

Socket type voltage Lincolntrol

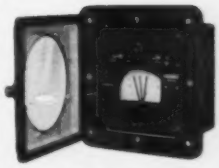


Voltage Lincolntrol with thermostat bias

Carryover socket type time switch



Carryover type time switch



Switchboard type Lincolntrol

To keep pace with your switching applications, Sangamo's new control developments, in addition to the above, are units for temperature control, current bias voltage control and sequence switching.

DEVELOPED TO MEET YOUR NEEDS:

New Lincoln Meters
FOR SYSTEM MEASUREMENT

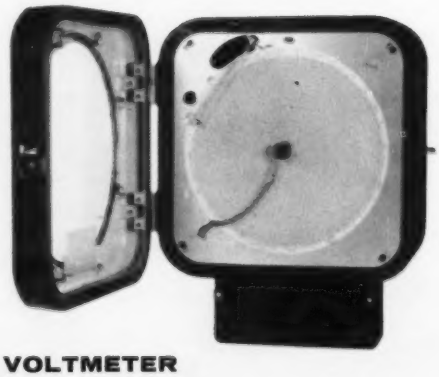
For simple low-cost network system load measurement

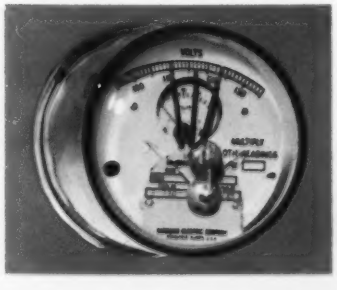
Developed for survey information on underground networks, new submersible split-core transformers and Lincoln graphic ammeter provide unusual flexibility.

Indicating ammeter can be permanently mounted outside vault using new split-core transformers located on network protector bushings.

SYNCHRONOUS-CARRYOVER GRAPHIC METER

Sangamo designed this graphic meter to keep the chart turning during power interruptions. The carryover-drive mechanism maintains timing for outages up to 14 hours and also provides a record of the number and time of outages.





LINCOLN INDICATING VOLTMETER

A newly designed model of the Lincoln voltmeter gives "steady state" maximum and minimum voltages and instantaneous readings for immediate indication as to whether the circuit is energized.

SM58-8

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

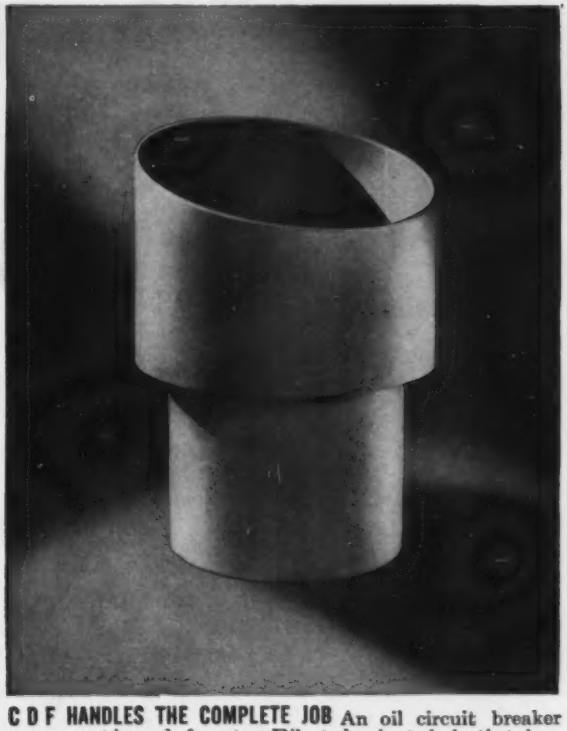
Utilities can depend on equipment containing C D F Insulating Parts

The reliable operation and long life of heavy electrical equipment often depends on insulating parts. A good supplier of insulation draws from past experience to make this possible—C-D-F has been a recognized industry leader since 1895! A good supplier expands his research and technical skill consistently—C-D-F offers the *widest range of electrical insulating materials*, from Vulcanized Fibre to C-D-F Products of Teflon.*

A BIG, RELIABLE SOURCE OF SUPPLY

As a buyer of Utility Electrical Equipment, you gain when your manufacturers work with C-D-F. Quality and dependability of electrical insulation, at reasonable cost, are guaranteed. The latest technical advances and ideas can flow freely between you and C-D-F's engineers. This page shows only a few of the many products C-D-F makes and fabricates for the electrical industry. Consult Sweet's Design File for catalog information, or call your C-D-F sales engineer (sales offices in principal cities)—you'll find he's a good man to know!

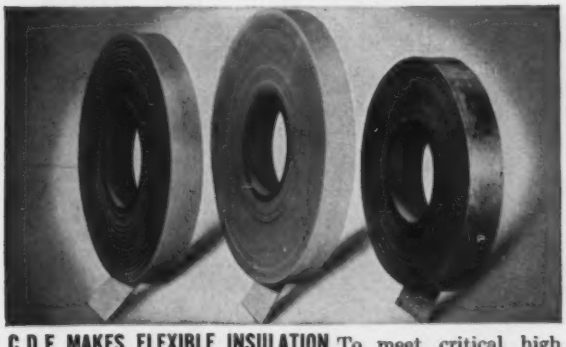
*Du Pont Trademark



C D F HANDLES THE COMPLETE JOB An oil circuit breaker component is made from two Dilecto laminated plastic tubes, with a threaded ring joining the assembly. From raw materials to finish machining C-D-F does it all!

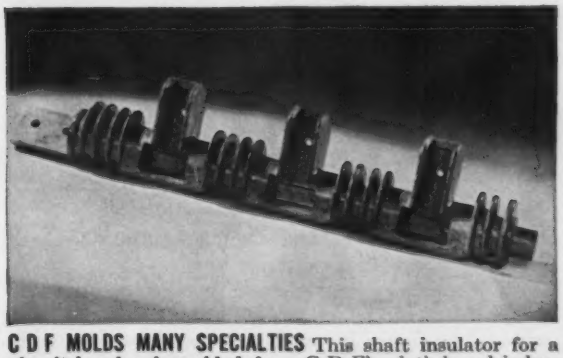
CONTINENTAL-DIAMOND FIBRE

A SUBSIDIARY OF THE Budd COMPANY • NEWARK 15, DEL.

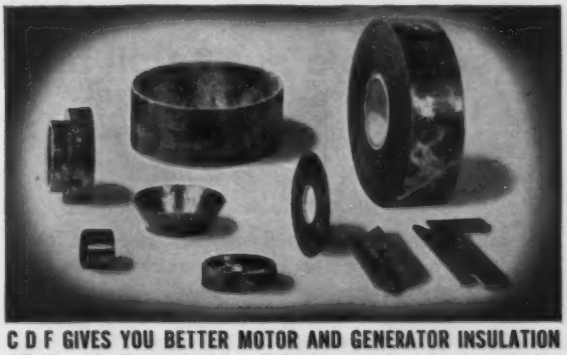


C D F MAKES FLEXIBLE INSULATION To meet critical high heat and electrical insulating needs, C-D-F makes these efficient, easy-to-apply tapes. Size range is wide, with latest resins and backing materials used. Write for samples and technical bulletins of Silicone, Teflon, and Micabond tapes.

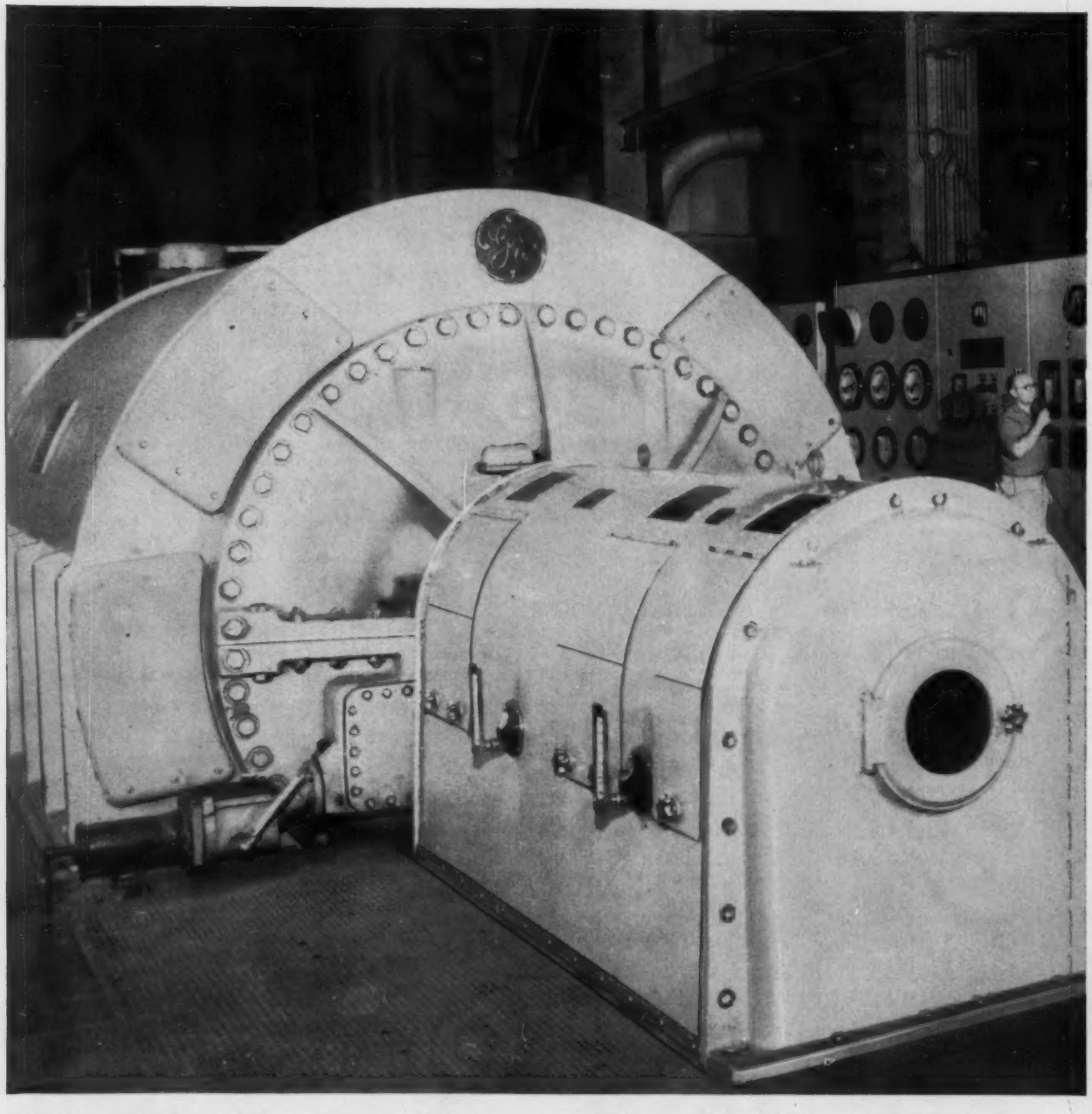
C D F UNDERSTANDS THE ELECTRICAL INDUSTRY'S NEEDS Precisely machined to close tolerances, Dilecto panel boards guarantee dependable insulation, help designers save space. New C-D-F Dilecto catalog is yours for the asking, lists all new grades.



C D F MOLDS MANY SPECIALTIES This shaft insulator for a circuit breaker is molded from C-D-F's cloth-based industrial thermosetting plastic, Celoron. Note complexity of mold, clean detailing. Celoron has high impact strength, is used in switchgear.



C D F GIVES YOU BETTER MOTOR AND GENERATOR INSULATION All these built-up and bonded mica products are made by C-D-F to provide uniform high-heat resistance and dielectric strength. All forms of Micabond are made for better performance and lower costs.



No downtime due to oil failure in 17 years! More proof that

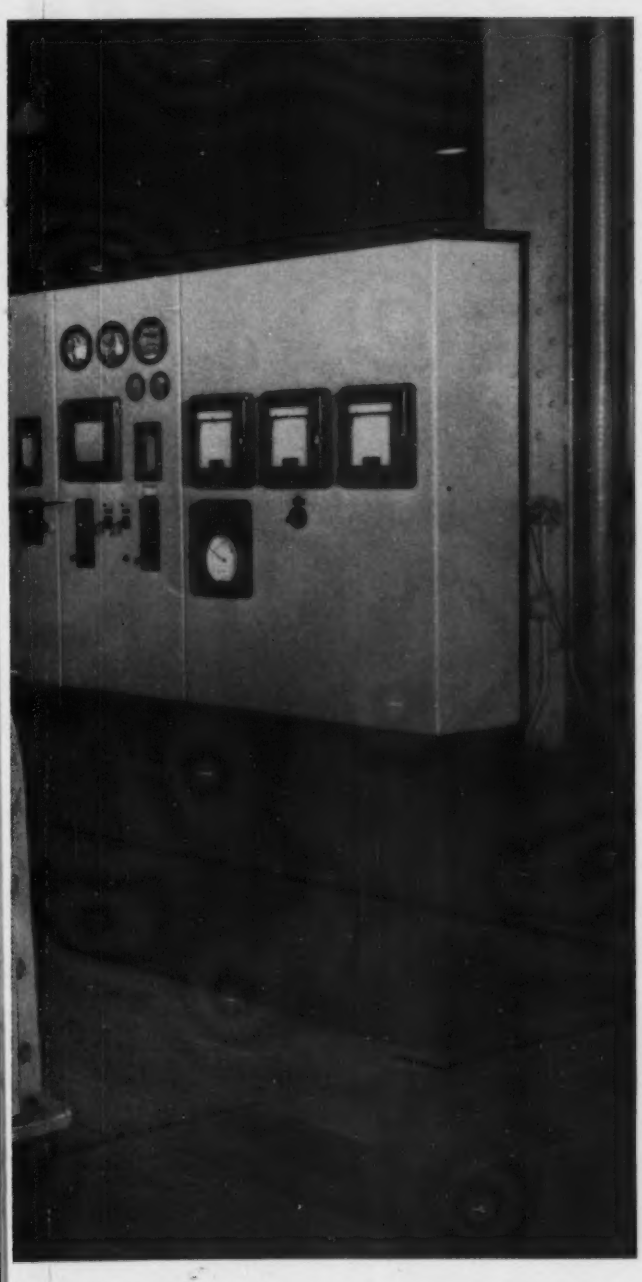
GULF MAKES THINGS

"During the last 17 years we have been using Gulfcrest turbine oil in all units and have had absolutely no difficulty with any of them due to oil failure."

An outstanding record? Yes, and the authority is Mr. B. H. Cheeseman, Supervisor of Operations at the Deepwater Power Station, Atlantic City Electric Co., Penns Grove, N. J. "And," he continues, "in that entire period our laboratory tests have consistently shown that the oil is stable, non-foaming, free of sludge and rust. Neutralization numbers are consistently low."

Mr. Cheeseman is not alone in agreeing that Gulf makes things run better. In Gulf's marketing area, more power is generated by central station steam turbines lubricated with Gulfcrest than with any other turbine oil.

Gulfcrest is the turbine oil produced by Gulf's exclusive Alchlor Process. This is an extra refining step.



B. H. Cheeseman (right), Supervisor of Operations, gets new lubrication recommendations from T. C. Park, Jr., Gulf resident manager.

Peter Egan, laboratory manager, makes periodic check on Gulfcrest. After 17 years the oil is still free of sludge and rust.

This 25,000 kw GE Turbine is one of five units (total, 230,000 kw) at Deepwater Power Station of the Atlantic City Electric Company. It has been lubricated with Gulfcrest for 17 years.

RUN BETTER!

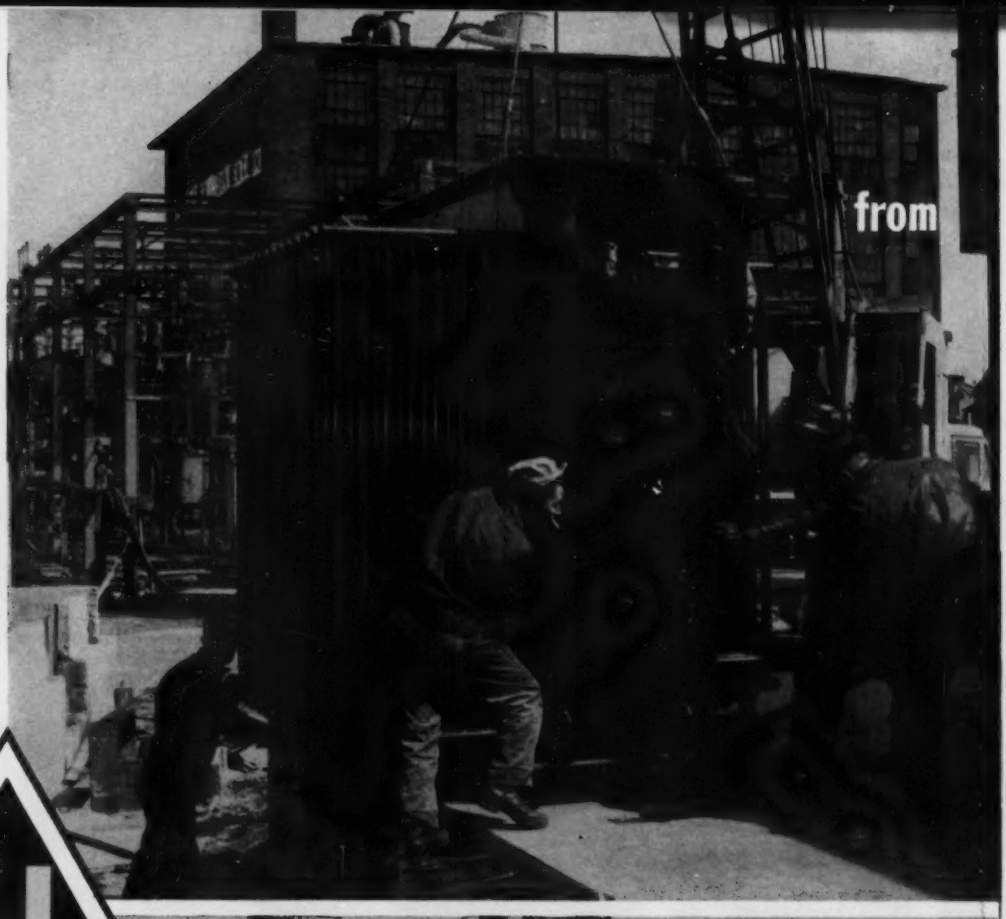
It weeds out harmful unstable hydrocarbons which remain after normal refining. If allowed to remain, these hydrocarbons could oxidize, form sludge, emulsifiers and harmful acids. Without them, Gulfcrest lasts longer, helps to keep turbine systems clean indefinitely.

Your job is to keep your equipment functioning efficiently. Gulfcrest can help you do just that. A call to your nearest Gulf office will get you all the facts.

GULF OIL CORPORATION
Dept. DM, Gulf Building
Pittsburgh 30, Pa.

GULF

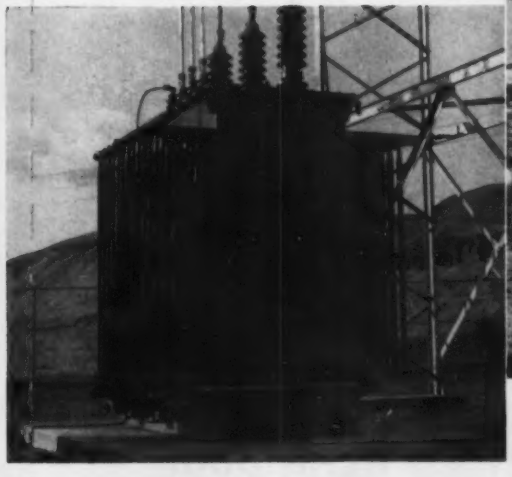
from



This 2500-kva Uptegraff power transformer, being installed at the Taunton Municipal Lighting plant in Massachusetts, is one of several units used in conjunction with a new 16,500-kw turbine unit.

One of several Uptegraff transformers furnishing power for the Benzene Toluene plant addition to the Richfield refinery at Wilmington, California. Long, trouble-free performance is vitally important in round-the-clock refinery operations.

MASSACHUSETTS to CALIFORNIA



Here is a 1500-kva Uptegraff power transformer located in Cleveland, Washington. It is one of several Uptegraff transformers serving the Klickitat County public utility at Goldendale.

This 1000-kva liquid-filled load center transformer is one of several Uptegraff transformers helping supply the power requirements for a new Celanese Plastics Division plant in Houston, Texas.

Uptegraff transformers serve industry's power needs!

The *extra* quality of today's Uptegraff transformers is due to a forward-looking program in research and development. This involves new and better raw materials, fabricating systems and assembly methods. It has resulted in important transformer advances . . . lasting oil preservation . . . completely leak-proof tanks and fittings . . . use of grain-oriented steel core for lighter weights, smaller sizes, lower core loss and exciting current . . . flow-painted exteriors assure three-mill paint coat and complete coverage . . . etc.

New designs provide capacity beyond normal rating

These improvements *plus* strict quality control in manufacturing and advanced testing methods assure the *extra* transformer capacity *beyond nameplate rating* to successfully withstand momentary overvoltages, high temperatures and other abusive conditions.

Meet the people of the Uptegraff Company

This picture-story booklet will give you an intimate view of the Uptegraff Company, and the people who design and build Uptegraff transformers. *Send for your copy TODAY.*

R. E. UPTEGRAFF MANUFACTURING CO.
SCOTTDALE, PENNSYLVANIA

METAL-CLAD SWITCHGEAR

HOW MUCH DO YOU NEED A HINGED REAR DOOR?

Some switchgear makers say you don't need it at all. They say you should struggle with a 75-lb. sheet metal cover and grope for the screw holes. That's good enough for you, they say.

But I-T-E gives you hinged rear doors as standard equipment on metal-clad switchgear—at no extra cost. And many other features besides. More solid construction throughout . . . means longer life. Sturdier enclosures to simplify installation. Finer finishes to give your whole switchboard a richer look. Examine an I-T-E switchgear installation. It is just plain better built. But you pay no more.

How much do you need I-T-E's double blowout coils —standard on 15 kv circuit breakers? Under all fault currents, here is extra protection, plus assurance of longer circuit breaker life that no other switchgear offers you. Yet I-T-E charges you no more.

Recently I-T-E developed FLAMETRAP insulation that snuffs out flame in seconds and leaves no toxic fumes. It is today's most advanced flame retardant insulation—now yours on I-T-E switchgear for no extra cost.

This briefly is I-T-E's policy: to make its switchgear better, in construction, performance and appearance—but to charge no more. Why not make sure that you get all the value your switchgear dollars can buy. Get I-T-E switchgear. For a complete outline of our extra-quality features, write Switchgear Division, I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa. In Canada: Eastern Power Devices Ltd., Port Credit, Ont.

I-T-E CIRCUIT BREAKER COMPANY
PHILADELPHIA, PENNSYLVANIA

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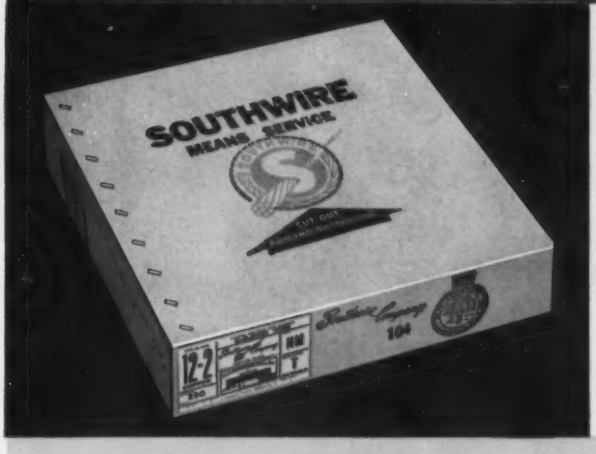
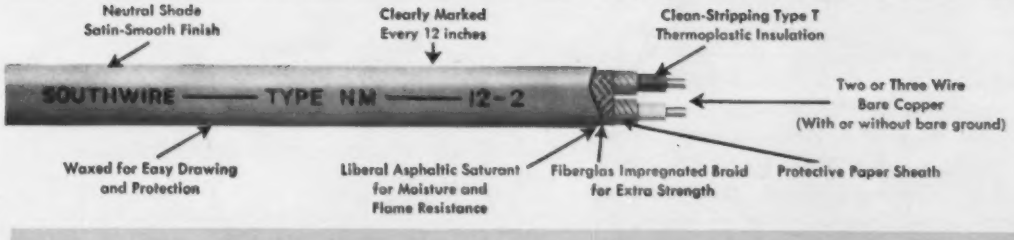
Southwire type NM SHEATHED CABLE



Made to National Electrical Code Specifications, and UL approved, Southwire Type NM Sheathed Cable is the answer for low cost wiring up to 600 volts. A full range of sizes—from 14/2 to 4/3, with or without ground wire—is available. It is packaged in cartons, coils, or on reels to customer's specifications.

Order Southwire Type NM Sheathed Cable and get Southwire Service — fast deliveries direct by our own trucks.



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- Neoprene, Polyethylene, and VWP (Vinyl) Weatherproof Copper, Aluminum and Triplex
- U.R.D. (DBWP, TBWP) Copper
- Copperweld® Conductors
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- ACSR and All Aluminum Cable
- Galvanized Steel Guy Strand and Static Wire
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Southern California Edison uses neoprene for service drops that "hold up" longer

In fast-growing Southern California there's a real housing boom and it shows no signs of letting up. The result is that Southern California Edison Company expects to be busy putting in service drops for years to come. That's why they're planning now to minimize the need for future maintenance on these installations. They're using 26,000,000 feet of neoprene-covered, three-conductor open-wire service drop and secondary . . . each year.

For Southern California Edison, the decision to use neoprene jacketing is a matter of neoprene's excellent reputation plus its own experience with neoprene during the past six years. The company has been especially impressed by the way neoprene withstands Southern California's atmospheric ozone, bright sunlight, and occasionally high temperatures.

Your supplier has neoprene-covered wire and neoprene-jacketed cable in types and ratings to meet your requirements. Neoprene synthetic rubber has compiled a record of durability and long-term economy in underground, overhead and underwater installations throughout the country.

If you'd like to know more about neoprene's performance and properties, just write for copies of our new booklet, "What Neoprene Is—and How It Protects Wire and Cable." E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. EW-11, Wilmington 98, Delaware.

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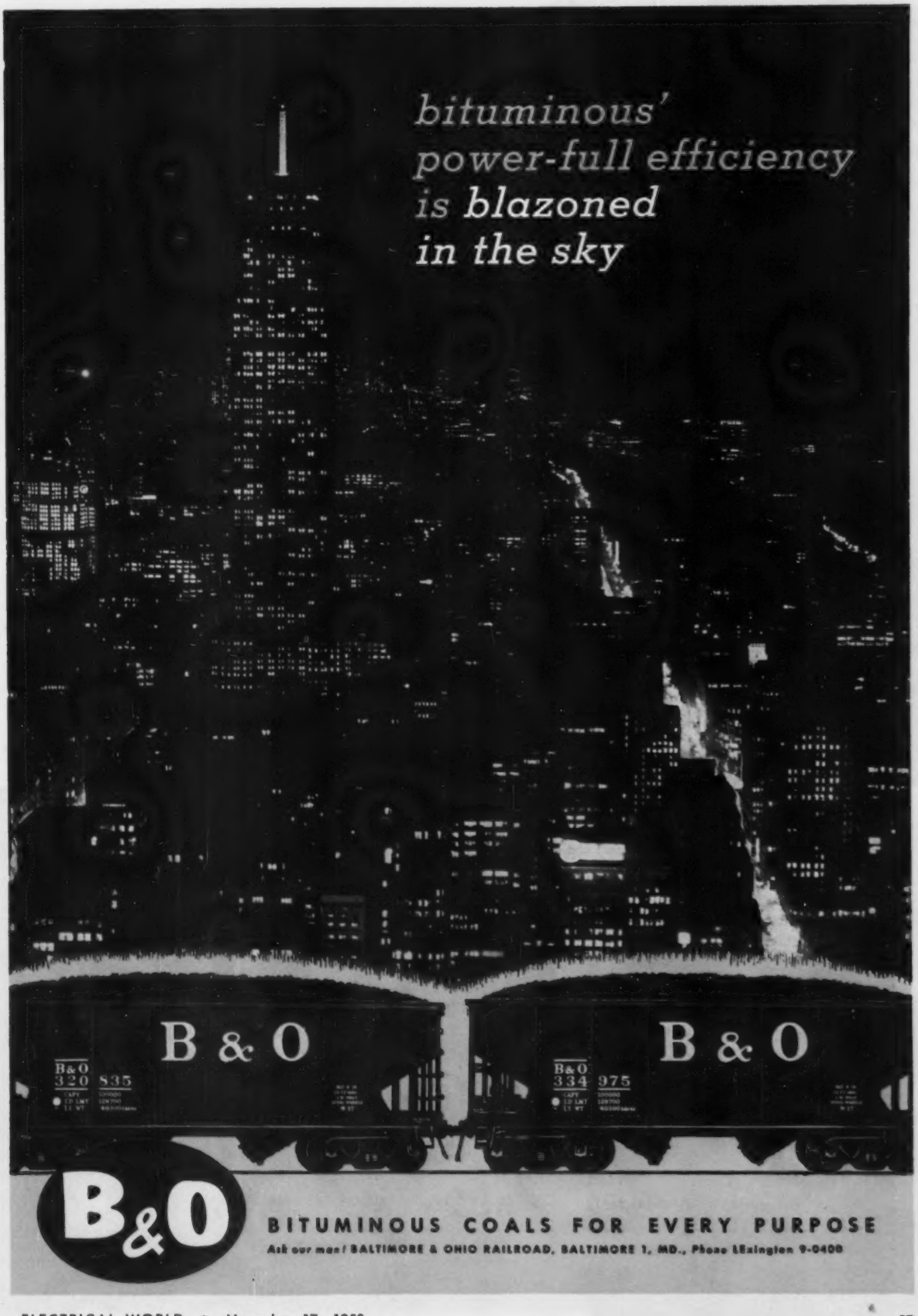
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Wagner has the facilities and experience to build power transformers in kva and voltage ratings to meet your requirements.

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ANOTHER 230 KV TRANSFORMER

Westward bound—a 15,000 kva, single phase oil-immersed, water-cooled power transformer recently completed by Wagner. *High voltage:* 230,000 Grd. Y/132,800 volts. *Low voltage:* 6900 Delta volts. Provision is made for conversion to forced-oil-cooling to maintain 100% rating. This unit is part of an order for ten 230 KV power transformers.

Wagner has been building fine power transformers since 1893, and today's production brings you the benefits of the skills and experience gained during these 65 years.

Consult Wagner about your next power transformer requirements. Your nearby Wagner field engineer is at your service. Call him or write us.

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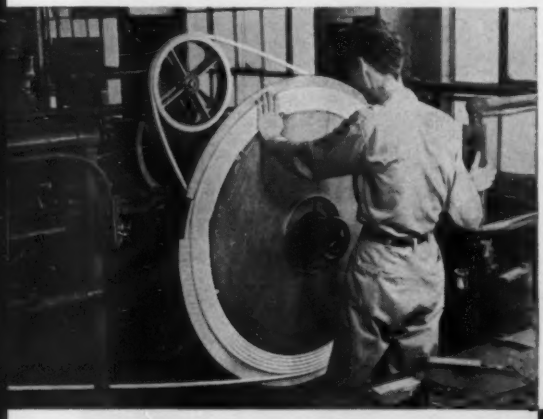
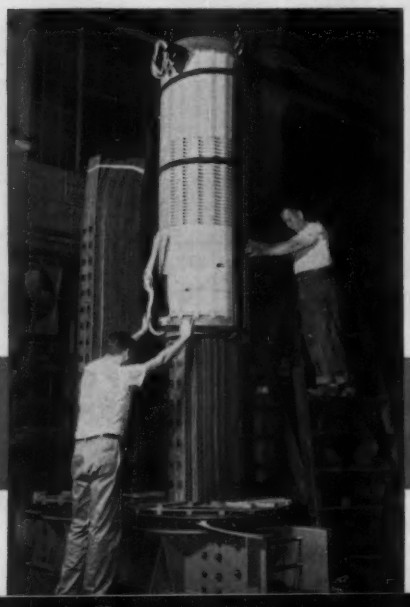


Two coils forming one double disk section of a high voltage buffer coil are wound simultaneously, with extra thick paper insulation.

The low voltage winding is placed over the core legs with the skill and precision of long experience.



W758-19

The completed core and coil assembly is locked rigidly into place—ready for the final insulating barriers.

Lowering the core and coil assembly into its tank is one of the many exacting jobs that are part of the day's work at Wagner.

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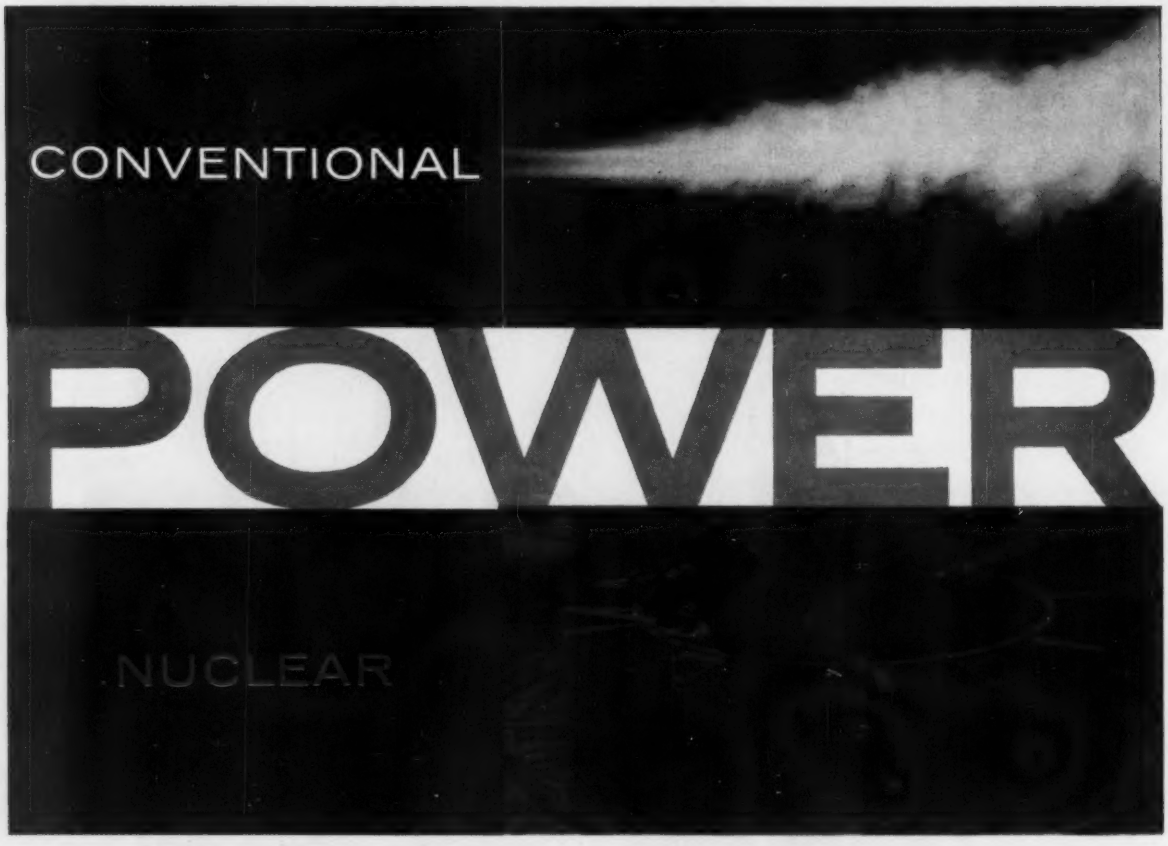
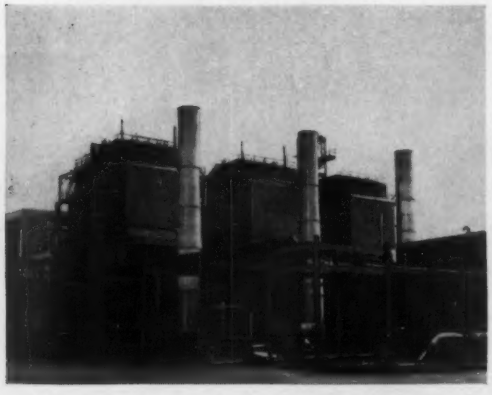
TO SERVE THE NATION'S POWER NEEDS



Kaiser Engineers can design and build you a better power plant, sooner, for less.



960,000 pounds/hour steam generator plant producing process steam, compressed air and 31,250 KW of electricity for alumina plant. Designed and built by KE.

A 475,000 KW power plant in Louisiana. America's Engineering Test Reactor in Idaho. A 100,000 KW industrial steam power plant in Pennsylvania. The engineering study for the AEC's Gas Cooled Graphite Moderated Power Reactor. A $10,000,000 dual-purpose process steam and power plant. New nuclear development projects in Europe, Asia and Latin America. This is Experience—electric power from both nuclear and fossil fuels. To which Kaiser Engineers couples Ingenuity to pioneer, to develop new methods, to achieve better plants, quicker, for less. For experience, ingenuity, and a cost conscious approach, call or write KE. Today.

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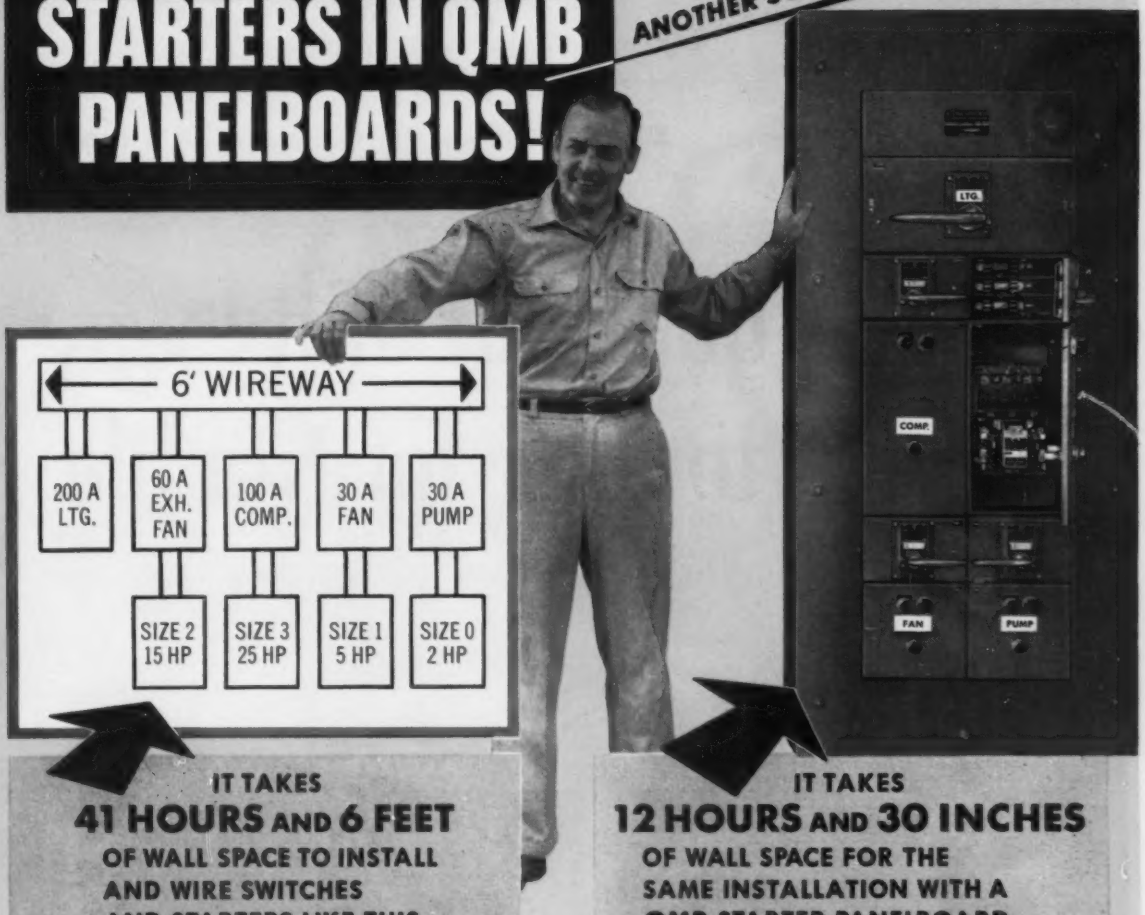
STARTERS IN QMB PANELBOARDS!

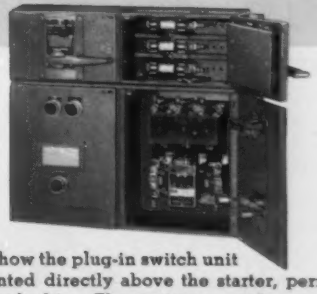
ANOTHER SQUARE D FIRST!



IT TAKES
41 HOURS AND 6 FEET
OF WALL SPACE TO INSTALL AND WIRE SWITCHES AND STARTERS LIKE THIS

IT TAKES
12 HOURS AND 30 INCHES
OF WALL SPACE FOR THE SAME INSTALLATION WITH A QMB STARTER PANELBOARD

Why mount separate starters and disconnect switches? It costs extra money. It wastes space. It takes a lot more time. QMB Starter Panelboards give you a *safer* installation because you can't open a starter when the switch is ON. They give you a much *better looking* job. Since they can even be *flush* mounted, they offer a lot more installation *flexibility*. QMB panelboards accommodate reversing and non-reversing starters, sizes 0 through 3. QMB switchboards and unit substations handle sizes 0 through 5. All of them are available, factory-assembled and wired. Or get enclosures, starters and plug-in switch units from your Square D distributor for on-the-job assembly.

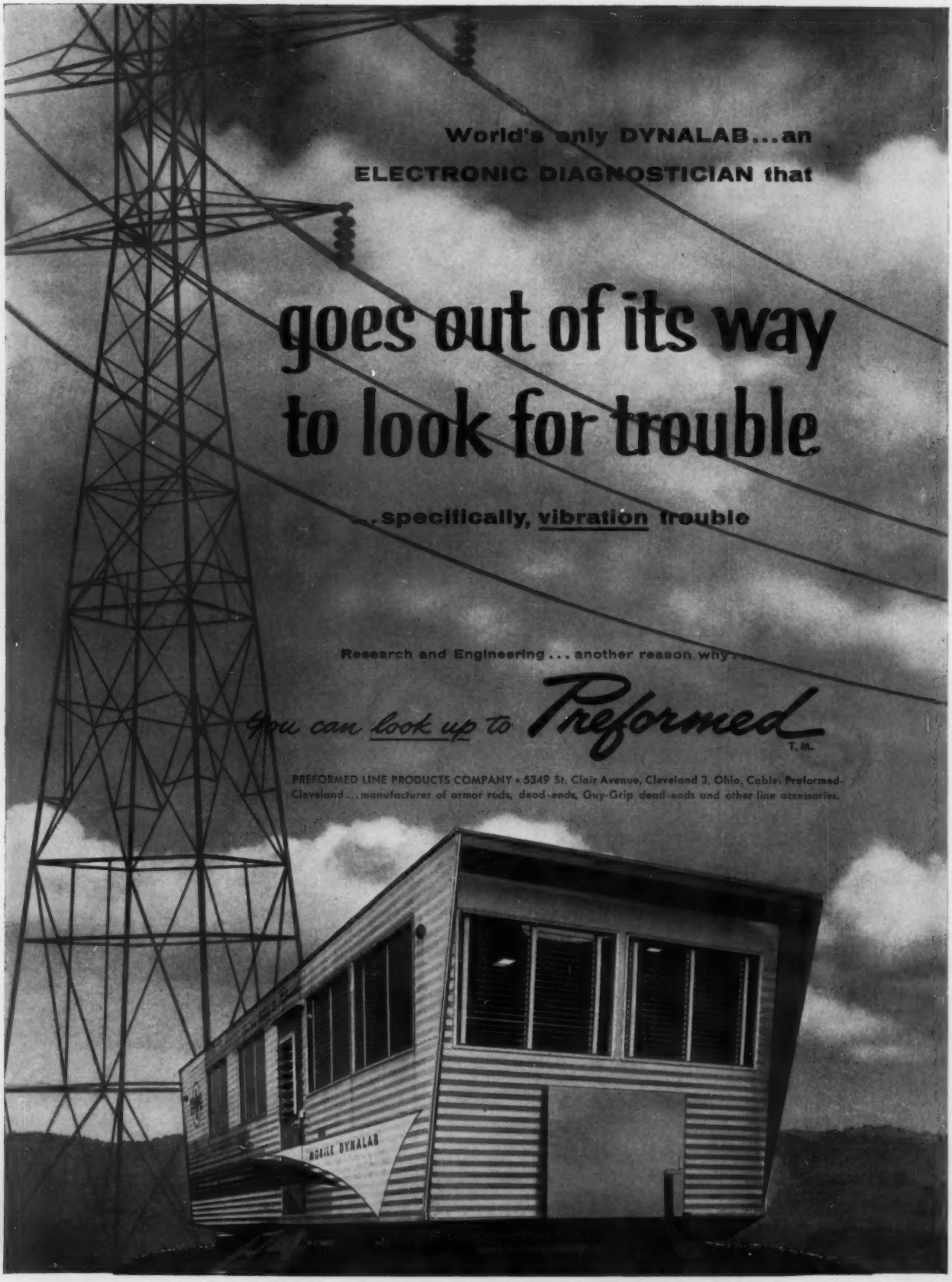


Notice how the plug-in switch unit is mounted directly above the starter, permitting interlocking. The starter cannot be opened when the switch is in the "ON" position.

It's easy to order these starter and switch units. See Page 57 in your Square D Digest and order from your distributor.

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY


World's only DYNALAB... an
ELECTRONIC DIAGNOSTICIAN that
goes out of its way
to look for trouble
...specifically, vibration trouble
Research and Engineering... another reason why...
You can look up to Preformed T.M.
PREFORMED LINE PRODUCTS COMPANY • 5349 St. Clair Avenue, Cleveland 3, Ohio, Cable: Preformed-Cleveland ... manufacturer of armor rods, dead-ends, Guy-Grip dead-ends and other line accessories.
AGILE DYNALAB

No. 3 of a series...

Vibration of overhead lines still represents a major problem to the utility industry. Although significant improvements in hardware design and construction practices have been brought about through expanded research efforts, the incipient hazard of conductor failures due to fatigue and abrasive wear is becoming an increasingly important problem as the size and cost of transmission line construction continue to increase.

Laboratory vibration research has steadily progressed and has recently been accelerated by the expansion of vibration test facilities and refinement of instrumentation and testing techniques. Field measurement techniques, however, have not kept pace with laboratory advances. Therefore, relatively little quantitative data is available from field investigations for extension of laboratory studies. A few outdoor test spans and isolated field measurements have provided only sparse and often inconsistent results due largely to lack of coordination of these projects and inadequate instrumentation techniques.

The mobile vibration laboratory (Dynalab) recently completed by Preformed Research and Engineering was created by a select team of vibration engineers and electronics specialists to fulfill this need in the practical solution of line vibration problems. Operational requirements were painstakingly studied in cooperation with leading utility engineers. Radical design departures were necessary to overcome the unique problems of instrumenting and monitoring energized EHV transmission lines. A special trailer was designed to provide the high degree of mobility required to obtain data from a variety of geographical regions and remote locations throughout the country.

Already in field service, the Dynalab not only represents a significant scientific advancement in obtaining vitally important field vibration knowledge but also exemplifies the progress possible through an integrated utility-manufacturer team approach to such important and complex industry problems.

Jon Ruhlman

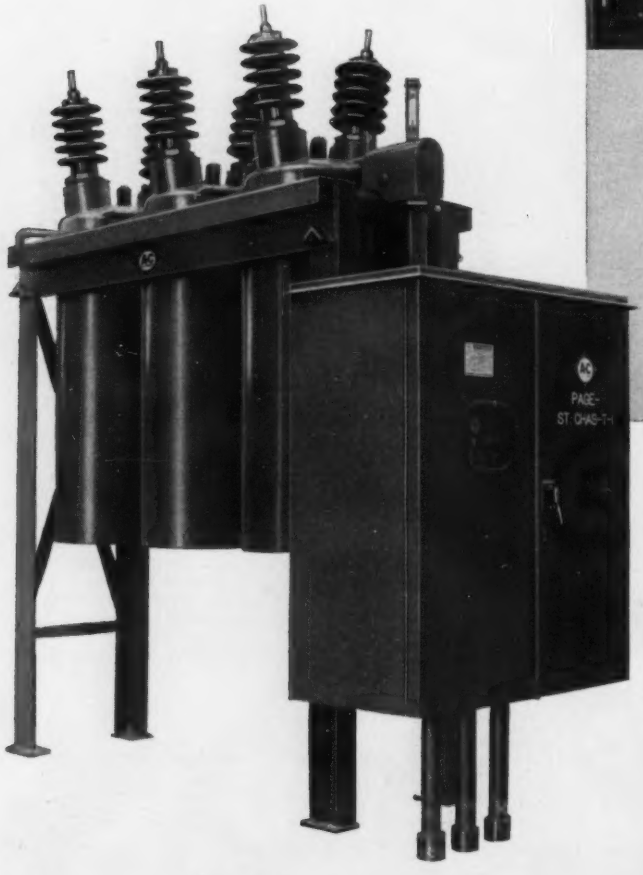
Jon R. Ruhlman, Vice President
Research and Engineering
Preformed Line Products Company

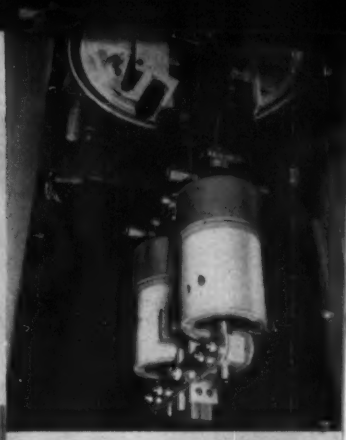
for
reliability

for ease
of maintenance

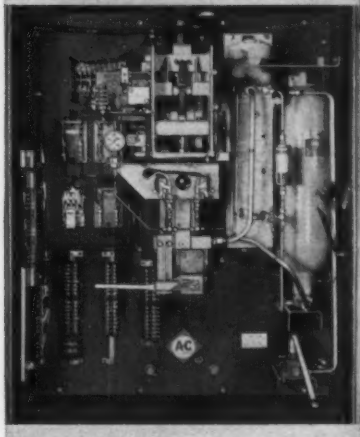
for ease
of operation

...3 top breaker features

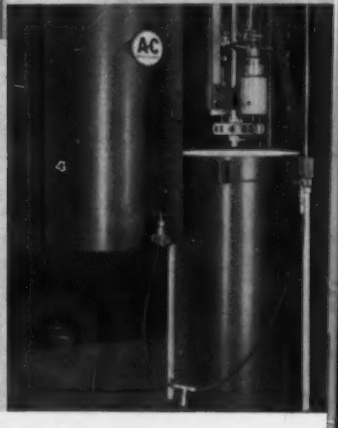




❶ Fast contact opening and closing proved by time and laboratory tests. *Turbo Rupter* device features bayonet and segmented tulip for wiping action, positive contact and absorption of mechanical impact.



❷ Simple design, with few moving parts . . . the *Pneu-Draulic* operator offers many advantages. Dust, dirt, moisture, heat and cold are no problems. Field-proved in dozens of utilities.



❸ Full access to tanks and contacts unobstructed by framework. In addition, optional power-operated hydraulic tank lifter eliminates hand cranking, makes it safe and easy to lower and raise tanks.

Allis-Chalmers large frame-type breakers have many quality features

Careful attention was given to every detail of design and construction. The result: today's top breaker value!

In addition to the features pictured above, you'll find self-cleaning, smooth, fabricated steel tops for each tank; ball-type position indicator visible from greater distances; float-type oil gauge that eliminates leakage; full tank skirt for added stability when tank is on ground.

For details, contact your nearby A-C office or write for Bulletin 71B8475. Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

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Editorial Comment

NOVEMBER 17, 1958

Understanding the Issues

We have information on good authority that the reasoning used by many of the voters who defeated the "right to work" laws was completely fallacious. That is, the uninformed voter did not vote on the true merits of the issue.

This is not too surprising. In New York, where we voted on several bond issues, the average and above-average in intelligence had a very difficult time evaluating the merits of each proposition. Voters in New York also had a difficult time comparing the two candidates for governor. One taxi driver, who was not much concerned with which of the candidates would do the most for the state as a whole, expressed doubt shortly before the election over which one would push hardest for rent control.

These are real illustrations of the simple problems involved in understanding the issues before us at election time. No matter how good a job is done by the newspapers in carrying articles and political speeches, the average voter usually goes to the polls still confused on many important but simple issues.

On the other hand, the public power issues in Oregon were understood or they would not have been defeated. The news from Oregon proves that party lines can be broken when the issues are clearly defined. This is the one bright spot to which everyone can turn in looking toward the future. A better job of informing the public will certainly provide better-informed voting.

Management has many opportunities and many communication lines for discussing the issues in the proper manner. Electric utilities employ over 250,000 people who can influence family and friends in much greater number.

One lesson from the recent election is that now is the time to formulate programs and policies looking toward the next, and next, and next time when candidates and propositions go before the electorate. Courses in basic economics are only the beginning. The day-to-day issues which shape the future must be dealt with as they arise, so everyone will understand their merits.

Cooperation Between Engineers Needed

Greater cooperation between electrical and mechanical engineers is imperative if we are to continue progressing in the field of power generation.

Obviously there has always been a great amount of cooperation. Anyone familiar with the design and operation of a power plant can attest to this. Our comments bear only on the degree of cooperation.

We believe more is needed because the growth of station size and the desire to reduce manpower requirements are making power plants more complex.

This in turn is forcing us to rely more and more on automation. And this definitely is a joint electrical-mechanical undertaking.

Both engineering disciplines must work together. The electrical engineer must understand the mechanical engineer's problems and vise versa.

Having electrical and mechanical engineers swap positions in design, operating and maintenance departments may help the cause. Or having them air their problems and also accomplishments in joint technical meetings, like the recent National Power Conference sponsored jointly by the AIEE and ASME, may foster better understanding.

But whatever means the industry or individual utilities take, it is imperative that they strengthen the ties between electrical and mechanical engineers.

Oregon Vote Cheers Private Utilities

Three public power measures defeated there. Nebraska payments in lieu of taxes legalized. Two Ohio towns retain municipal systems. Georgia county creates 'light districts'

One of the relatively few bright spots that power companies found in the Nov. 4 results was in Oregon. There voters turned down three proposals tied directly to private vs public power matters, and at the same time elected a Republican governor whose opponent was closely allied with the National Hells Canyon Association.

Here's what happened:

- Voters in the state refused for the fourth time to implement a 1932 amendment to the state constitution authorizing a state power commission. The legislative referendum was defeated by more than five-to-four.

The proposal would have removed the authority of the power development commission (if later established) to enter the retail field, but would have permitted sales to industrial users in blocks of 10,000 kw or more. The commission, with approval of the legislature, could have increased its bonding authority from 6 to 10% of the state's assessed valuation to develop steam and nuclear plants in addition to hydro.

- Portland voters turned down by a two-to-one margin a city measure which would have authorized a $5-million bond issue for installation of three 8,000-kw generators in conjunction with water supply system dams. Portland General Electric Co was prepared to negotiate for the purchase of power produced. Although PGE did not actively oppose the measure, it did not favor it.

Springfield Keeps PP&L

- In Springfield, a $3.5-million bond issue to finance the proposed purchase of Pacific Power & Light Co distribution facilities was defeated by a vote of 2,062 "for" and 2,322 "against." Competition between the city system and the power company has existed for eight years.

PP&L stated before election day that if the city proposal was turned down the company would like to see voters given an opportunity to consider sale of the municipal system to the company.

- Election of 36-year-old Mark O. Hatfield to governorship over Gov Robert D. Holmes cheered power companies. Holmes has had a close alliance with the National Hells Canyon Association and with backers of an initiative measure for a no-holds-barred state power set-up which failed last summer to reach a ballot.

Payments in lieu of taxes are now constitutional in Nebraska for power districts. Voters approved by a nine-to-five margin an amendment to the state constitution requiring power-selling public corporations to pay 5% of gross electric revenues obtained in cities and communities served at retail to those incorporated cities and communities. A portion of the revenue will go to school districts, county and state government units also. The measure must receive implementing legislation in the next session of the state legislature.

Actively backed by Omaha and Consumers public power districts, the amendment vote gets these districts off the horns of a dilemma posed by a Supreme Court ruling that in-lieu-of-tax payments were unconstitutional. Municipal systems and REA co-ops which are not serving towns will not be affected.

In Miamisburg, Ohio, voters turned down a proposal to sell the power generating system by 1,835 to 1,002. On the proposal, the vote was not so much concerned with the plant sale as it was with the annexation of a tract south of the city containing Dayton Power & Light Co's Hutchings Station. Sale of the municipal power plant was necessary to effect the annexation. DP&L had offered $1,287,000 for the plant in 1956.

Near Toledo, voters of Genoa rejected Toledo Edison Co's proposed purchase of the local distribution system for $262,501. The village will continue to purchase bulk power from Toledo Ed.

Hassle Brews on TVA Okay

A hassle is brewing in tiny South Fulton, Ky., on the local officials' intent to buy facilities of Kentucky Utilities Co. The citizenry voted 421 to nine on bringing in TVA power but, the South Fulton city attorney says, KU refuses to consider offering its facilities for sale.

A post-election move in Paducah indicates KU may face the same problems there. The city has hired Joseph C. Swidler, former TVA general counsel, to study the company's franchise and advise on a possible switch to TVA power. An unsuccessful ten-year period of litigation followed Paducah's last efforts to acquire KU's facilities.

Dissatisfaction of voters with the conduct of Grant County (Wash.) PUD affairs was evident at the polls when Fred Arlt, chairman of the PUD commission, was decisively defeated in his re-election bid.

Arlt was a central figure in a dispute which led to the resignation of Manager Glenn Smothers, dismissal

Delicate Decision

Balloting at Sturgeon Bay, Wis., poses a delicate albeit encouraging decision for Wisconsin Public Service Corp. The company has been studying sites in Sturgeon Bay and nearby Kewaunee—both now served by their own municipal systems—for a $27-million steam plant. A prime factor in the choice will be agreement by the selected city to sell its power facilities to WPS.

An advisory referendum at Sturgeon Bay found 2,395 voters favoring sale of the system vs 146 opposed. Meanwhile, Kewaunee officials indicated they'd welcome the plant under the company's stipulation. WPS will base its decision and price offer on studies now under way.

of the PUD's attorney and the calling of a grand jury to investigate management of the PUD.

Sales-minded utility men in the South are studying with interest a constitutional amendment approved by Dekalb County, Ga., voters. The measure authorizes county officials to create "lighting districts" in unincorporated areas. After the formality of state legislature ratification, any unincorporated area wanting street lighting will petition the county officials. Then a lighting district will be set up and the residents within the district will be taxed to pay for the luminaires.

Heretofore, street lighting in such areas of the fast-growing county next to Atlanta has been provided only by execution of contracts between an individual or a group and the power company before the county officials could act. Georgia Power Co says it looks as though about 2,500 luminaires might be installed in the next few years in Dekalb County.

California Snubs Partnership

Partnership plans for development of power resources suffered setbacks in California. Congressman Clair Engle, Democratic chairman of the House Interior and Insular Affairs Committee and strong opponent of Pacific Gas & Electric Co's proposal to build and operate Trinity River power facilities, was elected to the U. S. Senate. He was succeeded by another backer of federal Trinity development, Harold T. Johnson.

Power issues entered the Indiana race between Gov Harold W. Handley and Evansville Mayor Vance Hartke for U. S. senator. Hartke, 39-year-old Democrat, picked up rural support on his opposition to a Public Service Commission order requiring Rural Electric Membership Corporations to get PSC approval on applications for federal loans. Late in the campaign Handley announced his opposition to the PSC order, too, but advocated cost-of-money interest rates. Hartke won in a landslide.

Power companies in the New England states faced no major referenda issues Nov. 4. The long-range outlook, though, said one observer, indicates the importance of more popular awareness of tax burdens and wider comprehension of utility economic conditions.

EEI Takes Issue With A-Plan

Reaction to long-range program of Joint Committee on Atomic Energy may set the stage for renewed struggle

The Edison Electric Institute has taken issue with major points of the proposed long-range program for atomic power development outlined in a staff report of the Joint Committee on Atomic Energy.

As a result, the stage may be set for renewed struggle between joint committee Democrats and power companies.

The program recommended by the committee's staff would involve industry and government construction of ten or 12 power reactors in the next five to seven years, with total capacity of some 1-million kw.

Target Date Is 1970

Object of the program, which carries the implicit blessing of key members of the committee, would be to attain economic nuclear power in the U. S. by 1970 and in free world nations with high-cost fuels by 1968.

The proposed program is subject to change after further talks with both industry and the AEC. It is expected to form the framework in which the Democratic-run committee will hammer out its legislative program in '59.

EEI's reply to the joint committee's request for industry's comments had this to say:

"In general, we agree with the major objectives set forth for the program. However, we feel that certain changes and additions would serve to strengthen the objectives and provide more specific goals to be attained."

EEI made these observations:

- The program should clearly affirm the principle of maximum "participation in and ownership of facilities by private enterprise, and thereby assure that normal business incentives and the nation's normal business system will at the earliest practicable date replace government control and direction.

" . . . It should be recognized that commercial costs, which are the sole basis for determining economic competitiveness, can only be validly known through industry cooperation and operation of nuclear plants."

- Instead of assigning specific years by which competitive nuclear power must be attained, it would be better to aim at carrying forward a vigorous program of research, development and construction to attain economic nuclear power at the "earliest practicable date."
- The time lag between attainment of competitive nuclear power abroad and in this country perhaps should be put at five years instead of two, as proposed by the joint committee, in view of generally large fuel differentials.
- EEI concurs with the point that "In the research and development period ahead," U. S. nuclear leadership "should be measured in terms of technology and not in terms of quantity of nuclear kw."
- Flexibility, both in administration and technical decision making, must be provided for. Congress thus should leave details of the program to AEC to be carried out within the broad framework of policy established by Congress. AEC, in turn, should not be the sole judge of what projects should be undertaken, says EEI.

Government Control Noted

The industry group states that the joint committee program would "set the stage for detailed and virtually exclusive government control by requiring specific AEC designation of projects to be supported. The program should not only allow, but should effectively encourage projects proposed by the industry."

- Ample time must be allowed in the power demonstration program for submission, approval, and negotiation of proposals from industry. Legislation passed by the last Congress allowing industry only a few months to bid on the gas-cooled reactor project is unfair.
- AEC's primary role in reactor development should be in the areas of investigating promising reactor concepts, conducting R&D, and constructing and operating experimental reactors.

Debate Spurred on 2% Money

REA loan topic's becoming a hot one, Agriculture Dept feels and Hamil discovers

◀**STANDING OVATION** for Hamil, center, at annual NRECA meeting is contrasted by Oklahoma action to muzzle him

Kenneth L. Scott, director of the Agriculture Department's Credit Services, feels his department is hitting its target in spurring grass roots discussion of the 2% REA interest rate issue. "I think more electric cooperatives are thinking and talking about the interest rate than we realize," he told Electrical World.

Scott emphasized that the department hopes to spur such local debate by giving its views directly to co-ops in speeches, REA publications and letters. And he hopes that these discussions will lead to co-op support for Agriculture's views that: **1.** The 2% interest rate on REA loans should be raised to equal the cost of obtaining money by the U. S. Treasury. **2.** Co-ops should begin looking to private financing for construction needs.

NRECA Sets Off Fireworks

Agriculture's recently announced decision to appeal for support directly from co-ops and general farm organizations—bypassing the National Rural Electric Cooperative Association—has produced the usual NRECA fireworks. "The Rural Electric Minuteman," an NRECA publication, calls the announcement an "admission" of "cloak and dagger methods being used to get support for new legislation" before the 86th Congress.

And the association's regional meeting in Oklahoma City unanimously approved a resolution Oct. 31 to muzzle REA Administrator David Hamil. Hamil has been speaking at NRECA regional meetings, pointing out that the 2% rate is not an adequate rate of return to the federal government, and co-ops should consider raising it.

Hamil subsequently said he will refuse to appear before any group which attempts to limit his freedom of speech, and he appeared at an early-November regional NRECA meeting in St. Petersburg, Fla., only after assurances were received that he was free to discuss the interest rate issue.

The White House again is expected to recommend enactment of legislation to increase the REA interest rate and to permit private financing by co-ops. Scott also favors the establishment of a co-op credit bank (similar to the federal land banks), which could assume the job of lending money to co-ops for their expansion needs.

A persistent rumor, however, keeps cropping up that a group of co-ops plans to come out in support of the Agriculture Department's proposals in the next Congress.

Scott feels that most co-ops could absorb higher interest rates, and he also refuted the NRECA claim that "there's no such thing as a true cost of money" to the government. He said, "It has been the custom when federally-financed . . . programs have become sufficiently established that they no longer need complete government financing and supervision, then both branches of government have in the past taken action to gradually withdraw the government control and complete financing, and substitute therefor, through the action of the local people, their own efforts and supervision in providing capital."

Loan Ruling Hit

On another issue, Scott said Agriculture will not accept Comptroller General Joseph Campbell's revised ruling that the REA cannot make loans to co-ops for construction of power lines within a "reasonable distance" of existing lines. Scott pointed out that REA has consistently made loans to co-ops on three grounds: eligibility, feasibility, and necessity. No "area" limitation has been used by REA since its inception, he said, and none will be made until Congress so directs.

The Agriculture Department's new brief charges that the comptroller general's "modified test of REA loan authority" is not supported by "the Rural Electrification Act, in its legislative history, or in any relevant data." Agriculture categorically denied every major premise in Campbell's revised ruling against REA loan procedures in general and a $120,000 loan to Central Iowa Power Cooperative in particular (EW, Oct. 27, p 58).

Hamil Suggests 2½%

REA Administrator Hamil proposed that the interest rate on REA loans granted by the federal government be set at 2½% at last week's meeting of Mountain States co-op members. The hike would enable the REA agency to pay its own way, he said.

"If we were to compute the government's cost of the money it has loaned REA, our books would show a net interest loss to the government of about $32 million," Hamil said.

Clyde Ellis, NRECA manager, retorted, "If the Administration's high interest rate or Wall Street financing bills become law, rural electric co-ops will start falling at every hand."

AT GENERAL SESSION LUNCHEON, NEMA President Joseph L. Singleton (standing), chats with J. R. MacDonald (left), NEMA treasurer, and J. P. Hamblen (center), president of the National Association of Electrical Distributors

NEMA Stresses Research, Promotion

Annual meeting reveals optimism in manufacturers' programs. Singleton re-elected, Cordiner wins McGraw Award

Speakers and delegates attending the 32nd annual meeting of the National Electrical Manufacturers Assoc in Atlantic City generally expressed an optimistic view of business activity for the year ahead and the longer pull. Speakers emphasized the need for more intense research and for stepped-up promotion and sales programs.

Joseph L. Singleton, vice president of Allis-Chalmers Mfg Co, was re-elected president of the association. Newly elected vice presidents are Chris J. Witting, Westinghouse Electric Corp, and W. R. Persons, Emerson Electric Mfg Co. J. R. MacDonald of General Cable Corp was re-elected treasurer. (For other vice presidents see p 70).

Budget approved for next year is at about the same level as for the present year. Individual allocations reflect some shift in emphasis from the residential adequate wiring program to commercial and institutional programs.

To meet the growing demand for electrical products, manufacturers must plan larger capital expenditures in the next five or six years than they have made in the past 20, Don G. Mitchell, chairman and president of Sylvania Electric Products, Inc, told the NEMA meeting.

Mitchell, featured convention speaker, said the industry must base its planning on one trillion kwhr a year by 1965 or earlier, as well as on increased automation in manu-

DON G. MITCHELL predicts large rise in capital spending

RALPH J. CORDINER receives award for industry promotion program

facturing to meet growing consumer demands and to combat rising costs. He urged a "blend of mental free wheeling and a practical, and organized approach to your problems" rather than an "ivory tower" approach to them.

"Making more of something is only part of the story," Mitchell continued. "We must make greater quantities at lower and lower unit cost in order to hold our markets, let alone increase them. Not only that, but we must develop new products and new ways of making them —and we must do it in the face of a technology that is getting more and more complicated all the time."

Cordiner Wins McGraw Award

The James H. McGraw Award for electrical manufacturers was presented to General Electric Co Board Chairman Ralph J. Cordiner at the annual awards luncheon. Cordiner was cited for "outstanding personal leadership and continued encouragement and support of the 'Live Better . . . Electrically' program which has brought great benefits to the electrical industry and the public it serves."

Cordiner was lauded for recognizing that a new and integrated sales effort of unprecedented scope was needed to realize the full market potential of the electrical industry and for backing broad promotional effort "without company identification to encourage the active and enthusiastic cooperation, participation and endorsement of all electrical manufacturers, power suppliers and industry groups."

The award was presented by A. F. Metz, board chairman of Okonite Co. The award, established 32 years ago by the late James H. McGraw, founder of McGraw-Hill Publishing Co, honors those whose personal contributions and constructive thinking are of the highest order in the electrical manufacturing field.

Speaking before the Wire & Cable Section, C. S. Schifreen, Philadelphia Electric Co research engineer, said the industry's major challenge is to find and apply insulating materials to extend transmission capabilities beyond present thermal barriers. He said, "Coordinated research efforts by cable makers, insulating materials suppliers, and utility system designers are needed to meet the tremendous increases in electrical load in the future. Only through such a coordinated approach can research keep pace with progress being made in chemical technology."

Major appliance manufacturers announced all-out promotions to help electrical distributors, dealers, and power suppliers increase sales of electric ranges, dishwashers, and water heaters. These campaigns will be in cooperation with the "Live Better Electrically" project and Edison Electric Institute's new "National Electric Living Program". Appliance promotion means stepping up NEMA's work in consumer education and promotion.

C. H. Bartlett, Westinghouse, vice president, told the Wire and Cable Section that "electrical manufacturers, either for their own projects or for contract projects, are turning back about 6% of their sales income to research and development programs." That figure, he added, "amounts to about one-fifth of all the money that American industry is spending on research today."

Only two things can keep industry from attaining its goals, Bartlett said. "First, over-emphasis on the present short-range economic problems which would cause us to re-trench on engineering and development and stop the great strides in scientific progress now underway. The second danger is that the electrical industry will assume that all of these developments are coming and not adequately sell and promote the use of power."

Economists See Good '59

Fred H. Gowen, partner in a New York business consulting firm, told the Automatic Temperature Controls section that many factors point to a strengthened and expanding economy in 1959. Negative business forces of a year ago, "without exception," have become positive, and recovery today has assumed "such broad scale proportions as to suggest that business is establishing an unusually firm foundation for expansion in 1959," he said.

A. C. Farmer, consulting economist, warned of worse times ahead following four years of high activity. The financial storm which Farmer forecasts would start in 1962-63 and make the 1958 recession seem like a mild breeze. He said the nation's attempt to "spend itself into continuous prosperity by the use of an unlimited amount of borrowed money" is the main factor in the depression to come.

Under questioning, the economic consultant admitted his predictions could prove wrong if there is a strong swing to conservatism.

NEMA Elects Two New VP's; Re-elects Three

W. R. PERSONS
Emerson Electric

C. J. WITTING
Westinghouse

N. J. MACDONALD
Thomas & Betts

A. D. R. FRASER
Rome Cable

F. H. ROBY
Federal Pacific

U.S. Power Picture

- TVA plans no expansion, says Board Director Jones
- Neuberger asks new look at BPA preference clause

TVA has no plans to expand its facilities outside its present area of operations, according to Arnold R. Jones, director.

Jones said the federal agency was "fully compensatory" and charged that the opposition to TVA "comes primarily from the private power industry," regardless of "what the U. S. Chamber of Commerce and others say." The Kansas-born federal official was the speaker before the Chattanooga Kiwanis club at its regular weekly luncheon meeting. It was his first public address in Chattanooga.

"We are not interested in selling power per se," Jones said after the speech. "We are interested in demonstrating the vitality of low cost power as an instrument of resource development. The current TVA area is adequate for this purpose."

Jones said in his speech he believes the private power industry fears TVA may be eager to expand its present operating territory. He assured his audience that "we are concerned primarily in meeting the demands of our own territory.

"There is no policy with TVA," he said, "for spreading our operating territory." He said that "of course, there may be some adjustments on the periphery desirable."

Unless a program is set up to finance an expansion of present generating facilities, TVA will have an "operating deficit" in its power production by 1961, Jones predicted.

• Sen Richard L. Neuberger has called for a new look at the preferences and priorities clause of the Bonneville Power Act before a meeting of Lane County Electric Co-op, Inc.

Neuberger, sponsor of a bill before Congress to create a Pacific Northwest Regional Power Corp, said neither public nor private ownership of distribution systems should be the single decisive factor in determining who could get federal power, if there should not be enough to meet all future demand.

He said residents of communities "that decline to establish public utility systems should not, by that fact alone, be wholly foreclosed from sharing in the benefits of a region-wide power system. . ."

Pure public-power preference has been overridden by geographic allocations for the benefit of South Dakota in the Missouri Basin, for Montana at Hungry Horse, for Idaho in the high Hells Canyon Dam bill, and at the Priest Rapids project being built by a public preference customer itself, he said.

Neuberger suggested a schedule of priorities for the best use of hydro power on these "tentative lines":

1. Actual public uses (such as street lighting, municipal transportation systems, etc.).

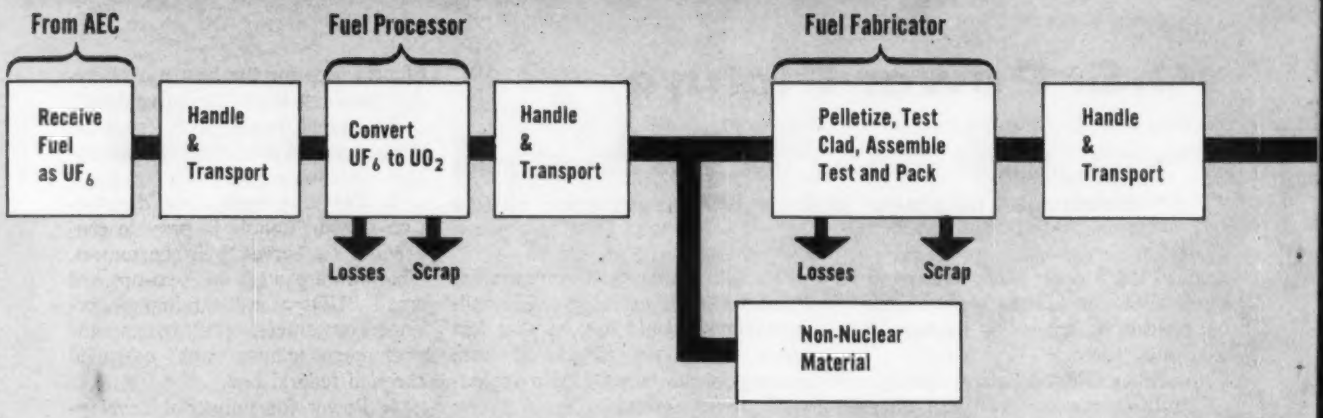
2. Public or non-profit distribution systems unable to provide generation to serve their customers. This would protect REA co-ops and small PUDs as outstanding preference customers, for whom the preference clause was extended through federal law.

3. Power for industrial development, whether delivered through a private utility, public lines or directly.

"These, I believe, should take priority over all other sales of low-cost power to ordinary consumers, whether served by public-preference systems or private utilities if a choice must ever be made," Neuberger said.

Chemicals Clear Rugged R/W 5 Years

Chemical weed killer applied by spray from a bulldozer is being used by Public Service Co of Colorado to clear fast-growing quaking aspen trees from power line right of way. Application of the spray kills seedling aspens and is effective for more than 5 yr, say PSC officials. The spray (Weedon) of 2-4-D and 2-4-5 T is mixed with distillate (5 gal to 150 gal) before it is placed in a 310-gal tank and air compressor pulled by the bulldozer. One tankful, a day's supply, is sufficient to kill young trees along 800 ft of the 75-ft wide R/W. The dozer, along with path clearing, also anchors the equipment on the steep slopes in western Colorado.



Nuclear Plant Estimating Difficult

Fuel cycle is more complicated than familiar conventional one. Title to nuclear fuel remains with government

J. J. **KEARNEY**, Assistant Managing Technical Editor

Estimating the cost of a nuclear power plant is difficult not only because of the lack of construction and operating experience but also because of the many dissimilarities between its cost and that of the more familiar steam plant.

Nuclear power plant costs can be divided into capital and operating costs like those of conventional power plants. The capital expenditures can be further subdivided into direct and indirect costs. And the operating costs can be considered as the total expenditures for:

1. Plant operation
2. Plant maintenance
3. Fuel

All of the various capital and operating costs for a nuclear plant vary somewhat from similar costs for a conventional plant. But the greatest differences lies in fuel costs. This is because the type of fuel, its preparation, and the disposal of its waste products are new to the utility industry. However, two other factors are probably more responsible for the complexities associated with nuclear fuel. These factors are:

1. Enriched nuclear fuel cannot be bought or sold in the open market. Title to it remains with the federal government. The various charges associated with its use are set by the government.

2. Under most licensing arrangements the user is responsible for the fissionable material from the time he receives it in a raw state from the Atomic Energy Commission until he returns the "spent" fuel to the same agency.

The flow chart above indicates all the various steps in a typical fuel cycle. Actually the chart shows the cycle for a particular type fuel—pelletized, cladded, uranium dioxide. But the cycle is a representative of most solid fuels.

The completion of the fuel cycle may take several years. During this time the fissionable material is not always in the possession of the user, although he is still held responsible for it.

Not all of the costs associated with the fuel cycle are chargeable to the fuel. Some are considered capital or plant operating costs. Those that are chargeable to fuel are:

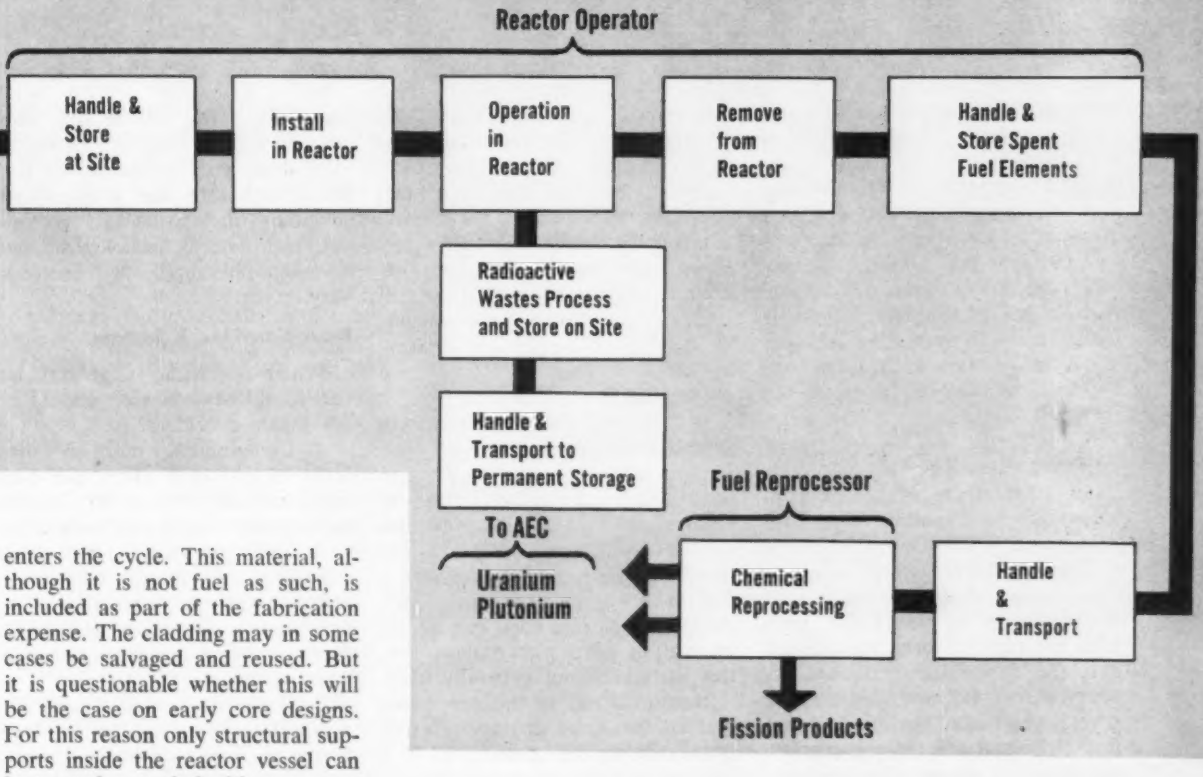
1. Use or inventory charge.
2. Conversion cost.
3. Fabrication cost.
4. Reprocessing cost.
5. Burn-up and degradation cost (less plutonium credit).
6. Transportation and insurance.

The use or inventory charge amounts to 4% of the value of the fissionable material per year. The user must pay this charge to the AEC. It is chargeable from the time the user gets the fuel in the form of uranium hexafloride (a gas) until the final accounting of the burnt fuel is made. Thus the longer the fuel cycle, the greater the inventory charge. It therefore behooves the operator to reduce non-productive time in the fuel cycle so as to lower the charge. Obviously he must exercise strict control of the various steps in the cycle to accomplish this.

After receiving the fissionable material as UF_6 it must be converted into a usable form. Several chemical firms offer this service. The fuel selected as an example was cladded, pelletized UO_2. But the same costs would be involved with other types —namely, the cost of converting the UF_6 to a usable form.

There are certain losses and scrap operations associated with this conversion. And although this will mean that the user will have less fuel available than what he leased from the AEC, he must still pay the inventory charge on what he leased —not on what he uses.

The next step in the fuel cycle and one involving a major expense is fuel fabrication. It is also where the accounting becomes complicated. At this point the non-nuclear material (cladding material, etc)



enters the cycle. This material, although it is not fuel as such, is included as part of the fabrication expense. The cladding may in some cases be salvaged and reused. But it is questionable whether this will be the case on early core designs. For this reason only structural supports inside the reactor vessel can be treated as capital with assurance.

There are several fuel fabricators capable of rendering this service.

There is a certain amount of losses in the fabrication which must be held to a minimum and in any case accounted for.

After this operation the fuel is shipped to the plant site. The expenses now encountered with its use are operating expenses.

When the fuel is removed from the nuclear reactor it is first stored on site to reduce activity. It must then be shipped to a fuel reprocessor. Here the various elements are separated from the spent or used fuel. This is a highly complex and costly chemical process. The unused enriched and natural uranium and plutonium must be recovered. The cladding material and less desirable fission products must, of course, be separated out in this process.

AEC Sets Charge

At present no private concern is rendering this service because of the lack of firm business and a reasonable chance for profit. Hence it is performed by the AEC as an interim arrangement. The commission will contract to provide these reprocessing services with owners of licensed reactors up to July 30, 1967, but will cancel any contractual agreements should this type of service become commercially available.

A daily charge of $15,300 for one ton with up to 3% enrichment has been established by the commission. This will apply to the time required to process a particular fuel plus "turnaround" time. Turnaround is the time necessary for a startup, shutdown, and cleanup preparatory to introduction of the next fuel.

There is continual handling and shipping of the fuel during the various stages of the fuel cycle. The charges for these, along with certain insurance costs connected with the handling and shipping, must be included in the total fuel costs.

In addition to the various expenses mentioned, the reactor operator must pay also for the fissionable material consumed. This expense is called the burnup and degradation cost. Burnup is the charge to the user for the amount of enriched uranium actually used. Degradation is the penalty that must be paid for lowering the enrichment of the fuel returned to the government. This occurs because the U-235, U-238, and plutonium that is produced fission at different rates.

Both the burnup and degradation charges are lumped into one charge. The charge varies with the degree of fuel enrichment. The latest AEC price list varies from $40.50 per kg for natural uranium (.072% enrichment) to $16,258.00 per kg for 95% enriched uranium.

The operator also receives a credit for the plutonium produced in his reactor. This too is a government set price. Until June 30, 1962 the government will pay from $45.00 per gram for plutonium free of the unwanted Pu-240 isotope to $30.00 per gram for plutonium containing 8.6% or more Pu-240. In the next year the price will become $30 per gram, regardless of the Pu-240 content.

As indicated, the charge for uranium and the credit for plutonium are fixed by the government. The AEC has indicated that the price of U-235, heavy water, etc . . . is based on cost and the credit for plutonium on "value". Breakdowns of these costs, however, are not as readily available to power engineers as those for fossil fuels.

Some industry experts believe that the $30 per gram buy-back price represents the military value of plutonium and that a considerably lower price would be closer to the true fuel value of plutonium. In many long-term analyses, $12 per

gram is commonly assumed as an eventual value. A "fuel value" price of $12 per gram has been established for foreign plutonium buying and indicated as the probable domestic "fuel value" price after 1963.

This apparent absence of any real competitive costs for nuclear fuels is one of the most important difficulties in estimating nuclear power costs. It is almost impossible to determine the price of the fuel over the life time of the plant. While it is true that the long-range estimates must also be made for fossil fuels, there is at least an economic base and a long-term price trend from which to start.

The inventory and burnup charges and plutonium credit cannot definitely be determined until after the fuel has been reprocessed and the fissionable materials accounted for. Because this may be several years after the material was first received from the commission, the matter of payment becomes important. If payment is made after the final accounting, it will be possible for the utility to set up a reserve account and make use of the money till final payment is made. Or, it is possible that periodic payments on an estimated basis will be requested by the AEC, an adjusting settlement being made after the final accounting. Although the manner of payment is more an accounting than a costing procedure, it should be taken into consideration.

Depends on Local Factor

In conventional plants, fuel costs are independent of load factor. This is not so in nuclear plants. The point is rather academic though because the effect is slight. The inventory charges are proportional to load factor. The shorter the period a given core is in the reactor the smaller the inventory charge. However, the effect on the total fuel charge is usually insignificant for most reactors other than low specific power types. And opposing this saving is the fact that the longer a given core is in the reactor the greater is the burnup and the lower the unit burnup charge. The better way to decrease the inventory charge is to decrease the fuel time out of the reactor.

The complexities of a nuclear fuel cycle are certainly vastly different than the operations in a conventional plant. But there are indications that, as experience is gained, operating utilities may be relieved of all the details of the fuel cycle. Several fuel manufacturers are offering a service whereby they will accept full responsibility for obtaining all fuel materials and delivering finished core loadings for a single fixed price.

Utility engineers must modify their terminology in discussing fuel. Present nuclear terminology is an outgrowth of physics research. As can be seen from the discussion on the fuel cycle, nuclear fuel is not bought by the ton or barrel with a certain heat content per unit of fuel. And although fuel costs can be expressed in cents per million Btu, this method is not generally used.

Burnup is one of the new terms derived from the physics research phase of nuclear power. It is a fraction or percentage which indicates the amount of fuel burned as a ratio to that theoretically available.

In addition to this, megawatts are used for both heat (reactor) and electrical outputs—a very inconvenient choice for the power business.

Another term to understand is megawatt-days per ton (MWD/ton). It is a measure of heat energy used to express the amount of heat that will be released during the core life per unit weight.

Perhaps the very first things that should be considered with capital costs are research and development costs. As time goes on, they will probably be absorbed by the equipment manufacturer in the price of his product. But at this stage of the art they are usually treated as a separate item. And because R&D costs are substantial, they should be accurately accounted for. Not many utility commissions have as yet made general rulings on the procedures for handling them. But some utilities have been permitted to handle them as operating expenses.

Aside from this uncertainty, capital costs break down into the usual direct and indirect expenses. In all likelihood the indirect costs of engineering, construction, purchasing, expediting, etc., will at first probably be higher. Lack of experience, if nothing else, accounts for this. More elaborate site preparations, including meteorological, geological, hydrological, radiological, and seismographic surveys will be necessary.

Must Consider 3 Factors

When discussing structures for the plant the following should be taken into consideration:

1. Containment and shielding must be provided. They are both expensive and require expert engineering and construction knowledge.

2. The low steam temperature conditions now usually inherent in water-cooled reactor plants may require more expensive and larger facilities for the non-nuclear portions of the plant.

3. Waste storage, treatment, and disposal facilities will be required. Some of these functions, though, can be provided on a contractual basis.

Another item in the capital account that needs additional consideration is land. Any estimate of nuclear costs will not be accurate unless a true account of land costs are considered. Isolation or containment are of prime importance for safety reasons. If the isolation approach is used, more than the usual amount of land may be needed. And containment, of course, entails a large structural expense. Nuclear power plants now operating, in design, or under construction provide safety with both containment and isolation.

Aside from the fact that the saturated steam conditions of water-cooled reactor plants will require large low-pressure equipment, there will not be much change in the non-nuclear equipment used.

The steam producing equipment will, of course, be completely different. In ascertaining the cost of the equipment it is well to make a detailed analysis of all the many auxiliary systems that will be required.

Accounting problems also arise with the capital items as they did with the fuel items. Moderators and control rods are two good examples of this. Both are subject to depletion. Both should probably be con-

sidered as capital as they are continuing investments. But such cases should be considered individually. And their value varies greatly depending on the material used. Heavy water at $28 per lb, for example, represents a substantial investment.

Interest during construction is an important item not only because of the sizeable investment but also because of a slightly longer construction period than that required for conventional plants.

What plant life should be used for depreciation purposes? Without actual experience, this surely is a matter of conjecture. But the consequences of the figure used should be fully realized when it is applied to the cost estimate. The AEC has used a 20-year life for its Hanford reactors and the material testing reactor (MTR). Westinghouse Electric Corp suggests a 20-year life. On the other hand, one large utility is considering a 35-year figure for its nuclear plant with an added factor for earlier depreciation for that equipment that will be subjected to more rapid deterioration.

Load factor is another item that cannot be estimated with accuracy. It is difficult to assign a figure for this over the lifetime of a plant when, to begin with, the life of the plant isn't known. The effect of future plants on the operation of the plants under consideration is also unknown. But one thing is known —capital costs of nuclear plants will be so high that energy cost will be greatly affected by the plant load factor used.

Operating expenses cannot be estimated with any degree of accuracy because of the very little operating experience that has been accumulated. But because experience gained to date is encouraging (EW, April 28, p 60), there is no need to be unduly pessimistic.

Consider New Personnel

The important thing is to realize the differences and similarities between nuclear and conventional power plant operation. Because of the experimental nature of nuclear power, the number and type of personnel will differ. Most utilities, which are on the threshold of operating nuclear plants, are convinced that they can train their present power plant operators to be nuclear plant operators. This part of the operation may prove to be pretty straightforward. But nuclear operation will bring with it new operating functions which may require additional operators, some of whose functions do not exist in present-day plants. These will include:

1. Health physicists for radiation surveys and control of both the plant and the surrounding area.

2. Chemical engineers for waste disposal in some types of plants.

3. Personnel to account for, control, and identify all fissionable and radioactive material. Although their function is not a complicated one it does mean an added expense.

In addition to these the various new auxiliary control systems must be attended to and may require additional personnel. Plant start-up will, in all probability, also require additional personnel and expense because of the experimental nature of most of the first-generation plants.

An encouraging aspect of nuclear plant operation will be the elimination of fuel handling crews. Because fuel loading and unloading operations will be infrequent, there is no reason why this function cannot be provided by an outside firm for a fee. This service will probably require a large crew for a short period of time.

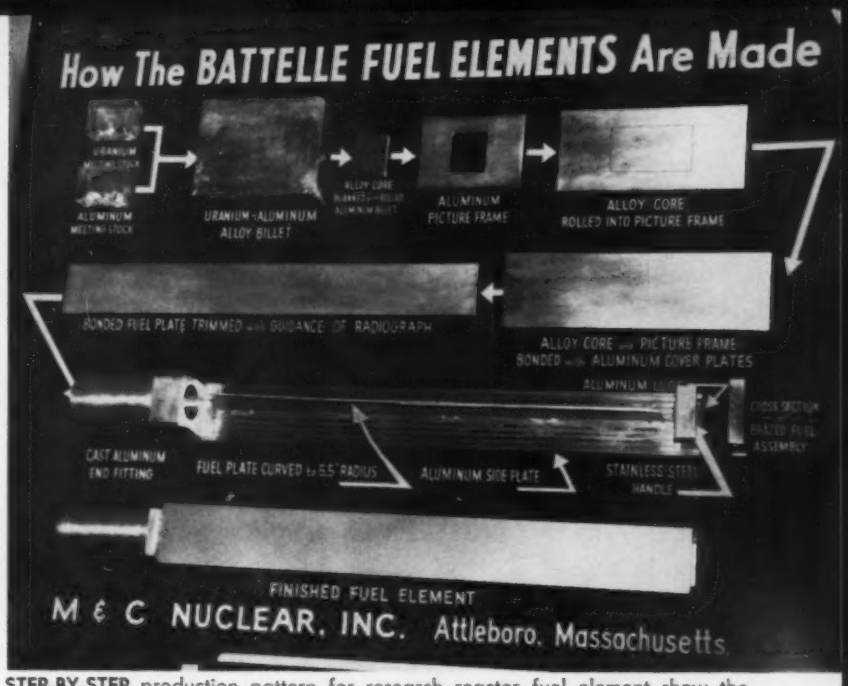
And third-party-liability insurance must be considered in detail. It will probably cost 3 to 5 times as much as insurance for conventional plants.

Estimating maintenance costs presents much the same picture—no experience, no reliable estimate. Similar to operating personnel, the caliber of man required will undoubtedly be higher than his counterpart in the conventional plant. Servomechanisms and complicated electronic gear will need very exacting attention.

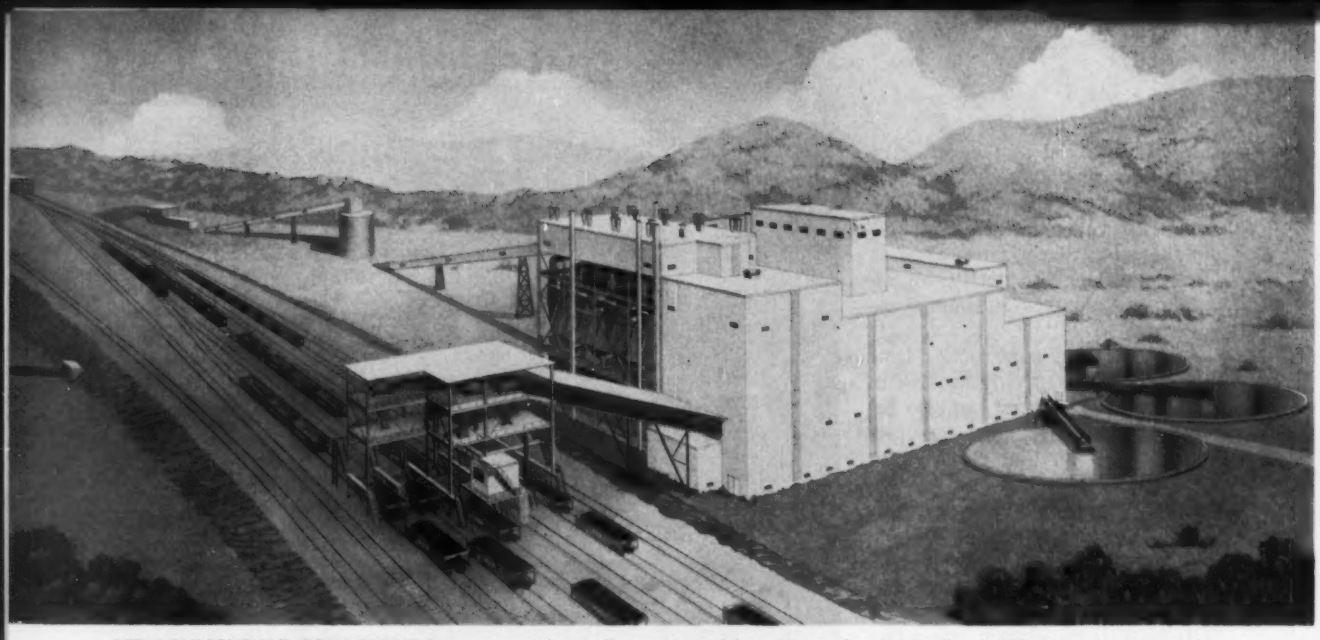
Maintenance requirements will probably differ greatly with the type of nuclear plant. In fact, this area of cost, which in conventional plants is relatively insignificant, may be a very important factor, especially so in the homogenous and other fluid-fuel reactor plants. Plants using sodium as a coolant will require special maintenance techniques.

Because of these differences, it would not seem wise to assume the same maintenance cost for all nuclear plants. And estimating this cost by applying a multiplying factor to conventional-plant maintenance cost figures seems unwise.

Another consideration in maintenance costs is maintenance capital equipment. Because of radioactivity, remote maintenance may be required in certain parts of the nuclear plant. This will take special tools, whose cost should be taken into consideration.


How The BATTELLE FUEL ELEMENTS Are Made
ALUMINUM MELTING STOCK
URANIUM-ALUMINUM ALLOY BILLET
ALUMINUM PICTURE FRAME
ALLOY CORE ROLLED INTO PICTURE FRAME
BONDED FUEL PLATE TRIMMED
ALLOY CORE AND PICTURE FRAME BONDED
ALUMINUM COVER PLATES
CAST ALUMINUM END FITTING
FUEL PLATE CURVED
ALUMINUM SIDE PLATE
STAINLESS STEEL HANDLE
FINISHED FUEL ELEMENT
M & C NUCLEAR, INC. Attleboro, Massachusetts

STEP-BY-STEP production pattern for research reactor fuel element show the complexities of the nuclear fuel cycle, making cost estimation difficult



NEW CLINCHFIELD COAL PLANT for steam and metallurgical coal has 10-Mw load, handles 1,500 tons of coal per hr.

Interruptions Minimized in New, Highly

Extra capacity for critical production areas, ground indicating systems keep plant in continuous operation

WARD J. HEACOCK, Electrical Engineer, Link-Belt Co, Chicago, Ill.

A 14,000-hp motor load with highly modern motor control and a 6.9-kv distribution system are the outstanding electrical features of the Clinchfield Coal Co's new Moss No. 3 coal preparation plant in Dante, Va. Incorporating all the latest and most efficient techniques to extract the last pound of coal and reclaim the last gallon of water, this plant has a total of 427 motors in the 400- to one-hp range, in addition to 109 fractional-hp motors. Approximately 200 miles of wire and more than 120,000 ft of conduit were used. Scheduled to go into operation late this year, Moss No. 3 will handle 1,500 tons of run-of-mine coal per hr.

Nothing has been omitted that will help keep the plant in operation. All important pumps have standbys, completed with motors. The operator can start both motors by throwing one double-throw switch and manipulating a few valves.

Ground indicating lights are provided for the 6.9-kv and 480-v power circuits and the 110-v control circuit. Alarm and signal circuits supplement "squawk boxes" as a communication system.

In the wet sections of the plant, where one piece of equipment may serve two preparation circuits, extra power centers and additional transformer capacity are provided to limit the amount of production loss in event of an equipment failure. Similarly, of the 12 centrifugal dryers, only 10 are used at one time, leaving two free for maintenance.

Group Starting Used

To reduce the time required to start such a large number of motors, group starting is used. One push-button starts several motors simultaneously and still maintains proper sequential interlocking.

Total load in the plant, including lighting, is 10,200 kw. Of the 427 motors rated one hp or more, several are standbys, leaving a total connected motor load of 13,634 hp, plus the previously mentioned fhp load. Among the 427 are 23 rated 200 hp or better, and 83 between 50 and 75 hp.

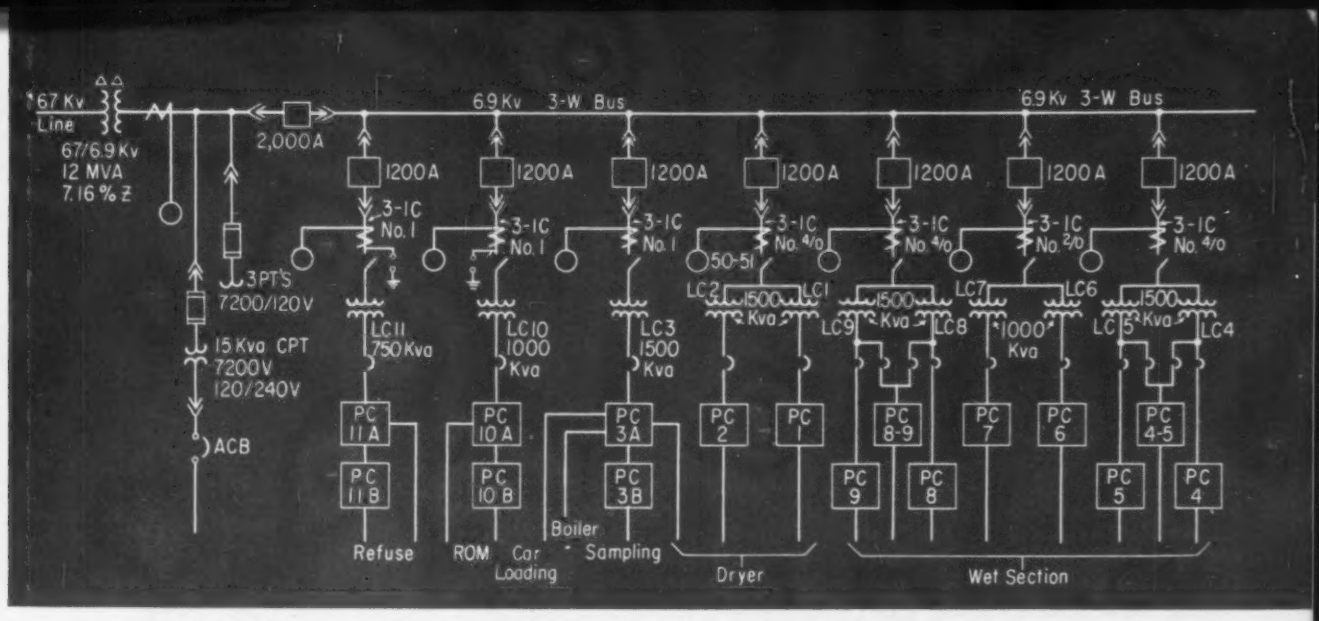
Power to supply the plant is purchased at 67 kv and delivered to a 12,000-kva, 67/6.9-kv substation. The transformer is a 3-phase, oil-filled type, radiator cooled with provision for future addition of forced cooling to obtain a 16,000-kva rating. Impedance is 7.16%.

The substation was sized on the basis of the calculated bhp requirements, from which the kw and kva inputs were obtained, plus the lighting load and losses due to transmission and control requirements.

Since the plant operates as an integrated unit, the load factor is about 90%. Almost all connected motors, excepting intermittent duty motors, will be running and well loaded. Variations in the percentages of different sizes in the product may shift the load from one group of motors to another somewhat, but the total will remain about the same.

The physical dimensions of the plant as well as standardization throughout sister plants, dictated the selection of 6.9 kv as a primary distribution voltage. The 546-hp travelling stacker conveyor is over 2,400 ft from the main plant, while the 200-hp run-of-mill crusher, and some 600 hp of associated drives are 600 ft in another direction.

Pre-assembled aerial cable is used to distribute to 6.9-kv power to the eleven 6,900/480-v secondary substations in a simple radial system.



EXTRA POWER CENTERS for critical wet section are key-interlocked, can be switched to either of two transformers

Automated Coal Preparation Plant

Size No. 1 conductors serve the refuse, R-O-M, and one dryer substation; No. 2/0 cable the "main" and No. 4/0 cable the other dryer and north and south areas. Selection of aerial cable was based on the desire to minimize wire corrosion, give better protection to personnel and reduce the danger from possible accidental contact with portable high lifting rigs.

Five such cable groups are suspended over the railroad tracks to the top of the main building servicing dryers and the "wet" sections of the plant. The other two circuits extend by pole line to the refuse and R-O-M areas. Each circuit is protected by a 1200-amp oil breaker.

Primary distribution is shown in the diagram above. To limit short circuit currents without the use of load limiting reactors, it was decided the secondary distribution transformers should not exceed 1,500 kva in rating. With this arrangement, the motors 200 hp and larger are protected by air circuit breakers with a 50,000-amp interrupting capacity, whereas the smaller motors on the same bus are protected by 15,000-amp plastic breakers with the bus section protected by 600-amp load-limiting fuses.

Secondary transformers are located close to their respective power centers to cut copper requirements, improve voltage regulation, and reduce low voltage breaker current requirements. However, to make them readily removable for repair, in case of a failure, they are located near the outside walls at the two opposite ends of the room, in which the power centers they serve are located. Overhead trolley beams, removable walls and detachable platforms provide means for setting the damaged transformer where it may be removed by a portable rig.

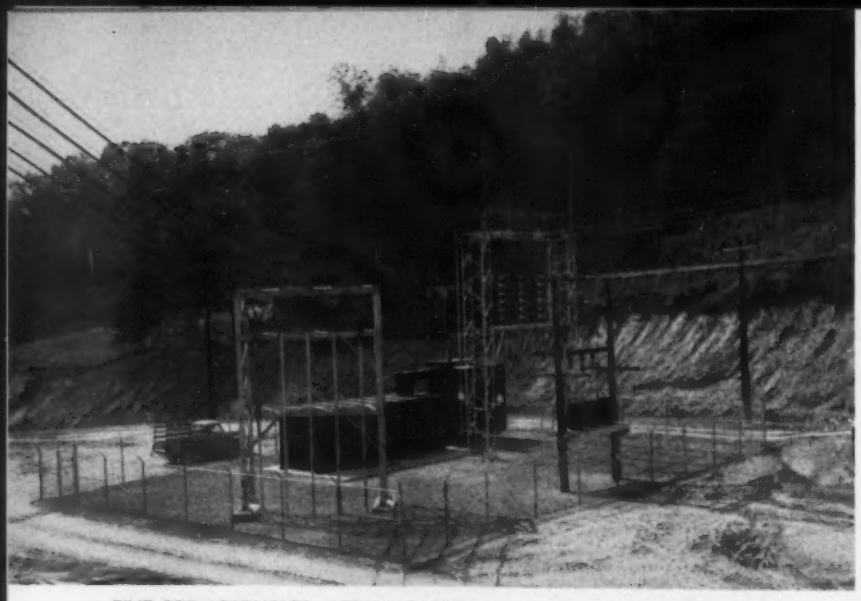
Spare Capacity In Wet Section

The 50 x 150-ft room for the "wet" section contains eight power centers, four three-phase 1,500-kva transformers and two three-phase 1,000-kva transformers. All of these six transformers are Pyranol filled, with a 5½% impedance. The metal-clad power centers are air circuit breaker type combination starters, line-start, for all but the large belt conveyor motors, which are wound rotor motors.

Transformers and power centers in this area are connected underneath with three 5,000-Mcm Versatol Geoprene interlocked armor cables each, laid in troughs, in a space beneath the power centers. In this same room, a 26 x 66 ft area is partitioned off to house the 80-ft long U-shaped operator's panel, which contains all the push-buttons and other instruments for the "wet" end of the plant.

In the wet sections of the plant, there are four parallel coal processing circuits. One transformer serves each. Because some of the pumps and conveyors serve two coal preparation circuits in common, two extra power centers are provided for these transformers as indicated in the one-line diagram. The odd power center in each group is key interlocked so it may be switched to either transformer if equipment along any one of the preparation circuits fails. Although this necessitates somewhat larger transformer capacity than would normally be required—i.e., 1,500 kva instead of 1,000 kva—three-fourths of the plant can be kept running instead of one-half in case of certain equipment failures.

Beneath the large wet section control room, covering the entire area, is a 5-ft deep space for cable racks and cables. It serves as a huge pull box to which conduits are brought from the motors. Single conductor motor leads and multi-conductor cables are then carried by trough to their respective power centers. By this means they are easily installed, inspected, main-



FIVE PRE-ASSEMBLED AERIAL CABLE circuits carry 6.9-kv primary distribution from 12,000-kva substation to main building. Two pole lines serve outlying loads

tained, changed if necessary, traced and ventilated. This space is pressurized by cool air drawn from the pump area at ground level and exhausted through the power centers to keep their temperature down to a favorable ambient. Although the air may be moist, it is passing over warm metal, so no condensation is expected.

The heat dryer and loading out sections are served by three 1,500-kva transformers, duplicates of those serving the wet plant. These transformers are located at ground level on 3-ft thick pads and are about 30 ft from their power centers, at a lower level. Transformers and power centers in this area are connected overhead by ventilated aluminum bus duct. The three power centers serving the heat dryer area occupy an 80x35-ft room with a 3-ft space below for cables. Immediately below is the heat dryer operator's control room housing a 28-ft pushbutton control panel for the heat dryers. The power center for the loading out section and its accompanying control panel are also served from one of these transformers.

One 1,000-kva 3-phase, 6,900/480-v, Pyranol-filled transformer is located at the crusher house in the run-of-mine area. It serves the 200-hp crusher, the rotary car dumper, two large conveyors, and other equipment in the area up to the surge bin.

The eleventh transformer, a 750-kva, 3-phase, 6,900/480 Pyranol-filled unit is located at the top of a hill serving the refuse disposal system. This system consists of a 117-hp travelling stacker conveyor with a 2,000-ft (ultimate) trailing conveyor, a 400-hp refuse slope conveyor and a few smaller associated motors and lighting. It can handle up to 700 tons per hr.

Capacitors Total 2,080 KVAR

To improve power factor and lessen the load on the feeders, a total of 2,080-kvar of capacitors are used. Each power center has from two to four capacitors of 80, 100, or 120-kvar rating, each with its own contactor and disconnecting means. These units maintain a minimum p.f. of approx. 85%.

Under light load conditions, the capacitors may be left off the line if desired. Each is relayed onto the line after a predetermined number of motors are on the line. Although this is done automatically in the sequence of operation, the omission of one capacitor switching operation will not interfere with the sequence starting.

With so many large motors in the system it might be questioned why synchronous motors are not used for power factor correction. It so happens that the largest motors drive conveyors and crushers for which synchronous motors are not suitable. A great many of the other motors, if synchronous, would have synchronous motors for standbys, a large investment not warranted.

Cabling from power centers to individual motors is by means of single conductor type TW 600-v cable. This is laid in troughs under the control centers, thence to conduits to the motors. This provides for cooling where the cable concentration is greatest.

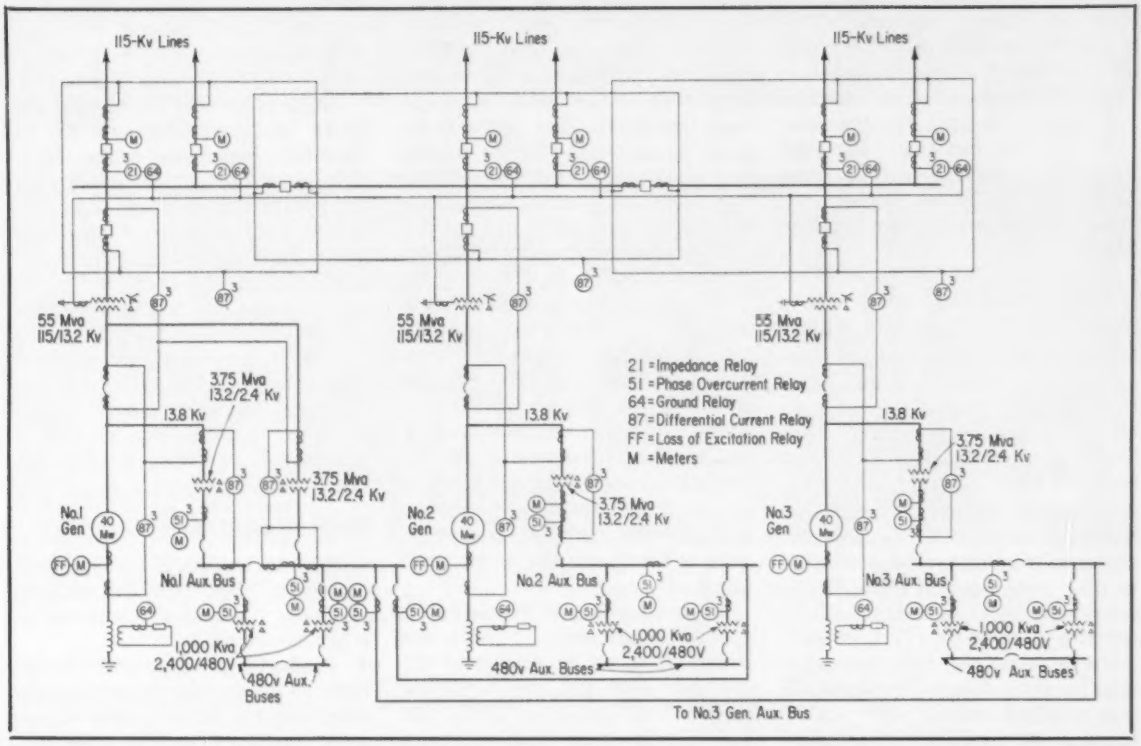
All motors are of the induction type, wound rotor for the large belt conveyors and squirrel cage for all other drives. Two types of enclosures are used, splash-proof for wet locations such as around pumps and enclosed, fan-cooled for locations that might tend to be dusty. No direct-current motors are used, but a considerable number of selenium rectifiers are used for magnets and vibrating feeders.

Most of the group-started units have separate start-stop pushbuttons at the motor. The start button is operative only if the panel selector switch is in the "out of sequence" position. In the "in sequence" position, the motor can be started only from the operator's position and then only if the sequencing interlocks are closed. For safety reasons, the remote stop buttons can be locked out. Along all the long conveyors, pull cords provide emergency stopping.

Control connections are made with multi-conductor cables. These are colored-coded for ease in tracing. Because of the great number of control cables and the relatively short runs and to have maximum accessibility for changes, they are carried in troughs and ducts.

The large wound rotor motors driving the belt conveyors are controlled by a combination of primary and secondary resistors which require only three contactors to provide smooth, uniform, and virtually stepless control of acceleration. All other starters are across-the-line for simplicity and maximum acceleration. Fortunately, most of the big motors start when there is minimum loading on the transformers and no one transformer has an excess of large motors.

Perimeter grounding is used. Ten-foot copper ground rods are driven around the perimeter of the plant. Bare copper, attached by lug to the ground rod, is brazed to a ¼" steel plate which in turn is welded to the building columns. All cabinets and motor frames are grounded.



RELAYING SCHEME for Higgins Plant is indicative of protection for steam plants. The 10% sensitive percentage differential relays operate on an auxiliary tripping relay that handles five major functions of generator protection

Relay Changes Aid System Capability

Planned modernization boosts system capability at a cost of about $3 million: standardization cuts costs three ways

M. F. HEBB, JR, Relay Engineer, Florida Power Corp, St. Petersburg, Fla.

J. T. LOGAN, Consulting Engineer, St. Petersburg, Fla.

Florida Power Corp has increased its system capability by releasing latent transmission capacity through modernization of protective relaying. The program also has standardized relay schemes to an extent previously believed impractical. This standardization has cut engineering, installation and maintenance expenses.

Relay modernization resulted from a study started 12 years ago to assure optimum use of the system in light of a forecast of phenomenal growth and capital expenditures. Before the study, efforts were concentrated on fault-clearing time, with less emphasis on utilization of line capacity. This practice built up considerable line capacity that could be released through judicial application of relays. Use of newer relaying schemes not only deferred line expenditures through release of latent capacity, but also solved many stability problems by permitting lines to operate at stability limits during emergencies.

The program adopted provides for newer types of relays in every classification and stresses standardization. For example, all lines in the transmission backbone, including 115 kv and 69 kv, use one type of phase-angle distance relay for phase protection of short lines and a second type for long lines. This standardization greatly reduces engineering and construction costs and minimizes operating and maintenance expenses.

The recommended program seemed overly ambitious at first but, as benefits began to accrue, it was accelerated. At one point relatively new switchboards, not originally in the program, were retired because of misapplications.

In the modernization program to date, about $3 million has been invested in protective relays, metering, and circuit breaker control equipment. This sum, about 1.5% of the company's capitalized value, appears trivial when compared with the gain in emergency capacity and savings in design, installation, and maintenance expenses.

In any protection system, it is

essential that relays see an exact replica of primary conditions. This is possible through use of bushing CT's and suitable potential supplies. Nine CT's are provided for each circuit breaker; six are relay types and three are for metering. Potential for metering and relaying is obtained from three PT's with double secondaries connected wye-wye/broken delta.

Protects Generator

Generator protection includes differential, field failure, ground, voltage-restraint overcurrent, and negative-sequence relays. The program also covers station auxiliary protection to automatic dual power supplies.

Generator differential protection is through use of 10%-sensitive percentage-differential relays connected to their own matched CT's. These relays operate a hand-reset auxiliary tripping relay that: (1) trips generator breakers, (2) trips generator-field breakers directly, (3) trips station auxiliary running power-source breaker, (4) actuates turbine emergency shut-down sequence, (5) closes standby auxiliary power-source breaker, and (6) shuts off fuel oil supply.

Field-failure protection consists of an impedance-type phase angle relay applied for alarm purposes on small units. On units above 45 Mw, relays trip generator breakers only when loss of excitation might cause instability. The operator unloads smaller units before disconnecting them. If evidence indicates that field-failure relays should disconnect the unit quickly to prevent damage from overheating, this practice will be adopted.

A ground relay is applied in the secondary of a distribution transformer between the generator neutral and ground. This relay operates an annunciator if a ground develops on the generators, transformer winding, or 13.8-kv bus, so that the dispatcher can unload the unit. Chances of such a fault spreading to another phase before shutdown are too remote to justify tripping a unit under full load.

Negative-sequence protection is applied to all units 15 Mva and larger. It is set to disconnect the generator from the system, leaving each unit to supply its auxiliaries. This relay backs up the basic system on single-phase faults. However, it is questionable whether the relay will respond fast enough under the allowable integrated product setting of $(I_2)^2 = 30$ to prevent a single-phase fault damaging generator bearings from vibration. Voltage-restraint overcurrent protection is applied to 15-Mva and larger units.

Phase protection for 115-kv and 69-kv backbone lines consists of three-step, impedance- or reactance-type, phase-angle relays suitable for addition of carrier pilot. With generation located in five major load areas, stability is not a problem. Fault-clearing times of 5 to 35 cycles, including breaker opening, will prevent serious conductor burning. A 30-cycle delay for faults in remote zones, with similar delay in reclosing, has not caused system split-ups. But, carrier pilot protection will be added if instability comes with increasing loads.

These Schemes Used

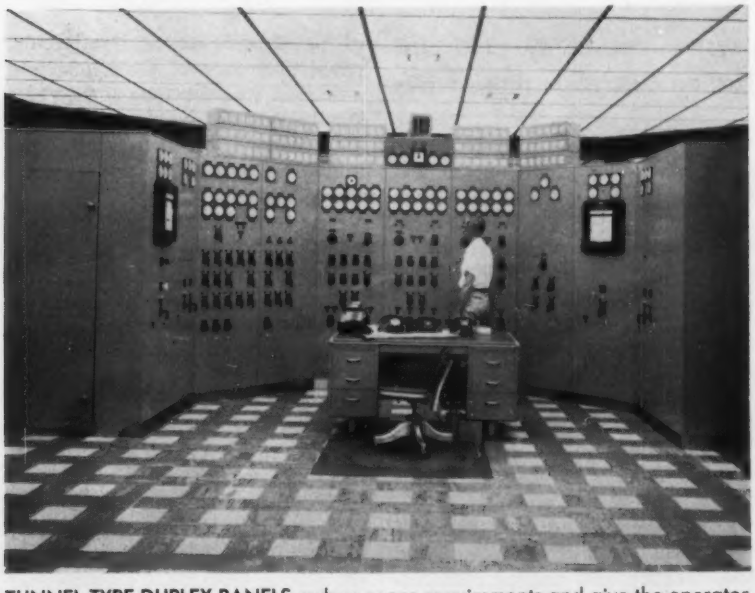
For transmission ground-fault protection, these types of relaying, involving different polarization schemes, are used:

1. Product-type relays with current coils in series are normally used when very low zero-sequence impedance, resulting from large grounded-neutral transformer banks, appreciably reduces the magnitude of ground-fault current from the protected line into or through the station. Depending upon relay characteristics, ground-fault current from the station into the line must be at least five times the back-feed to assure coordination with relays at the remote end of the line. In this case, ground relays in effect become inherently directional due to time-current characteristics and require no residual current source for polarization. If necessary, the relay can be made directional.

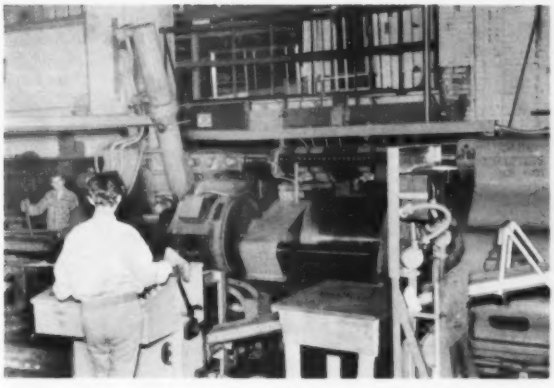
2. A current-polarized scheme is used when zero-sequence impedance is too low to employ potential polarization, yet not low enough to make the relay inherently directional with its current coils in series. Polarizing current is obtained from CT's connected to measure fault-current contribution from the tertiary winding.

3. Potential polarization is used when a neutral-ground source is absent. Zero-sequence potential is provided from a broken-delta secondary of the bus PT's. For this scheme, the zero-sequence impedance must not be too low, that is, too close electrically to a large

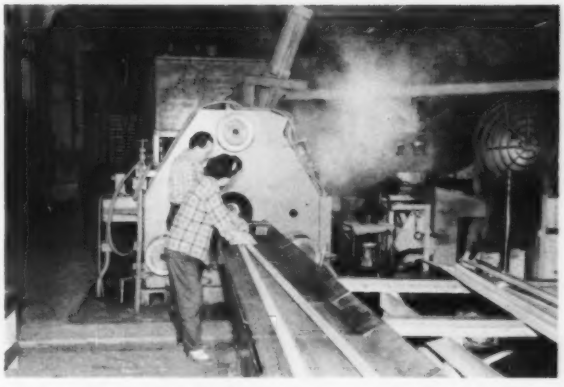
(Continued on page 143)



TUNNEL-TYPE DUPLEX PANELS reduce space requirements and give the operator a better view of meters. Rear angles and filler panels mount certain meters, instruments and relays. The board controls three 45-Mw units and a substation



Using high frequency heater...



and modern, high speed extruder...

Automated Line Speeds Aluminum Extrusion

Finished shapes come from extruder at rates of 50 to 75 ft per minute.

Continuous process assures close control of tolerances, uses a minimum of labor.

L. ALBERTSON, Supervisor, Sales Promotion Section, Philadelphia Electric Co., Philadelphia.

Electric heat and electric power are two of the vital elements in a highly efficient operation used to produce aluminum shapes at the Air Master Corp. in Philadelphia, Pa. Turning out high quality extrusions, which are ultimately used for storm windows and doors, at a rate of 50 to 75 feet per minute, the continuous operation cycle uses a minimum of labor and provides close control of tolerances on the extruded shapes.

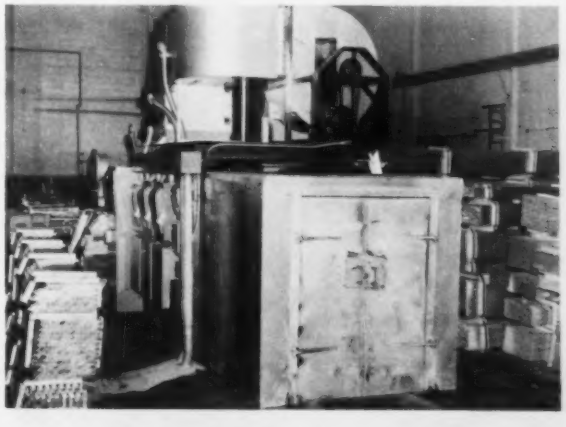
First unit in the automated production line is a 400-kva high frequency induction heater which brings the 47-lb. aluminum billets up to temperature of about 800 F in slightly more than one minute. The heater is supplied from a 2,400-v, two-phase line.

When the billet reaches the proper temperature, it is discharged down a gravity conveyor. Delivery of the heated billet is controlled by an operator situated at a control panel at the end of the conveyor.

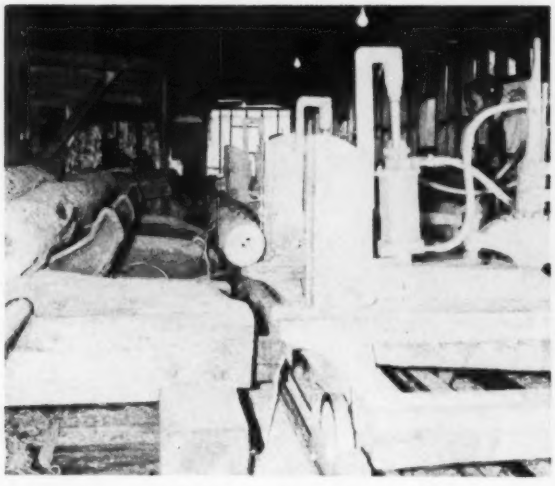
At the proper time, the billet is fed into a modern, 2,500-lb. extruder which is the heart of the system. Delivery rate is one every 66 seconds. To prevent the billet from cooling down during the extrusion process, the container on the incoming end is heated by resistance heaters totalling 30 kw. The hydraulic ram on the unit is powered by a 200-hp pump motor. Depending on the size and thickness of the shapes, up to six extrusions can be produced simultaneously at speeds of 50 to 75 ft. per minute. The extruded shapes range up to 70 ft. in length, depending on the number extruded at one time.

To facilitate handling, the extrusions are then cut to the desired length. After cutting, the extruded aluminum shapes are placed in a 150-kw, electrically heated oven for tempering. Strips are loaded in one end of the oven, heated for two hours at 400 F, and then unloaded at the other end. Cooling is permitted under natural atmospheric conditions.

Total power load for this highly automated process is in excess of 750 kw.



150-KW ELECTRICALLY HEATED oven is used to temper extruded strips. Extrusions are baked at 400 F for total of two hr.



From incoming log . . .

to treated lumber . . .

Electric Conveyors Increase Saw Mill Productivity

HOMER H. TURNER, JR., Industrial Power Engineer, Alabama Power Co., Birmingham, Ala.

A modern electrically powered conveyor at the Swann Lumber Co., Lafayette, Alabama, has increased production about 50% and cut the labor force approximately in half by eliminating virtually all the manual handling in the operation. Now, from the time the logs are unloaded until the final stacking of the treated boards there is no manual handling except for guiding logs and boards from one conveyor to another.

Logs are moved from the incoming trucks to a 50-hp debarker. From there they are carried to a 200-hp head rig, with a hydraulic gun and carriage, where they are squared. Then they are conveyed to a 150-hp gang saw, which cuts them into boards of the desired thickness. From here the lumber is conveyed to a tank, where it is dipped in a fungicide. Finally, the treated boards are conveyed to the yards for stacking.

Including sawing and planning sections, the mill now utilizes more than 40 electrical drives and a total of 1,000 hp to increase productivity. The electric conveyor is superior to a steam conveyor in that it is more portable, requires less space, is safer, and more economical to install and maintain.

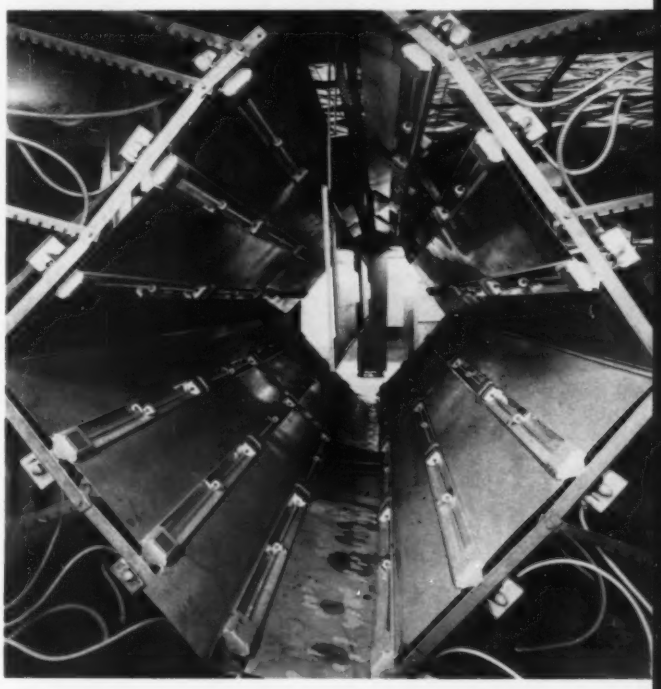
Lighting Boosts Efficiency

CARLTON W. WOLFE, Works Engineering Dept., Westinghouse Electric Corp., Elmira, N. Y.

Quality lighting for the engineers and draftsmen in a new Equipment Development office of the Westinghouse electronic tube plant, Elmira, N. Y. has improved employee efficiency and made seeing easier and quicker. Moreover, it provides a brighter and more cheerful atmosphere in which to work. A maintained intensity of 75 foot-candles was obtained with two Slimline fixtures mounted in continuous rows on 7-ft centers. Fixtures with 45% upward light are suspended 1.5 ft from a 10-ft ceiling. Louvers which provide 45 x 45-deg shielding lower the brightness of the fixture. Total lighting load is approximately 24 kw.

Conveyorized Oven Improves Paint Job Quality Control

W. F. HUTCHINS, Industrial Power Engineer, West Penn Power Co., Ridgway, Pa.

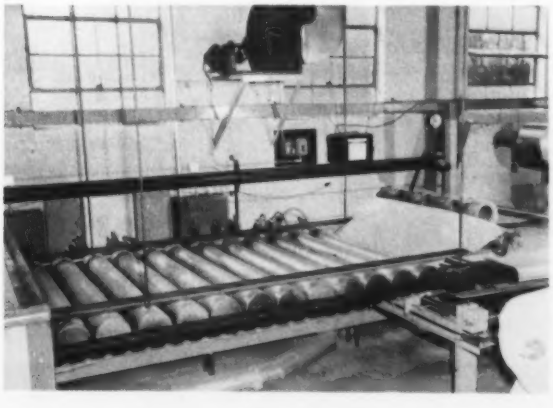


A neater job of paint drying, accurate control of the speed and depth of baking, fewer rejects, and better quality control of the finished product – these are the results that Kane Mfg. Co., Kane, Pa., reports for their new conveyor-type paint drying oven. Used in finishing sheet metal sections for electronic cabinets, the oven has 48 radiant strip heaters, arranged in a diamond pattern, with the top open for the conveyor.

Each wall of the oven has three rows of heaters, with four 1.8-kw units in each row. Each section of 12 units is individually switched. In addition, the second section is operated by an input controller. "This gives us the accurate control we want of speed and depth of baking," reports production manager Lester Baum, "because we can control the initial stage of baking."

The oven is Kane's own design, based on their experience with an infra-red lamp oven which proved inadequate. The input controller switches the units in the second section off and on, according to a predetermined cycle which depends on the size of the object and the type of paint used. The conveyor is powered by a ½-hp variable speed motor which provides conveyor speeds of 120 to 3 inches per minute.

Infra-Red Curing Steps Up Production of Sheer Fabrics



Highly efficient infra-red heaters and a radiation pyrometer, installed to cure dye on sheer fabrics, have boosted production by 800% at the Union Textile Co., Secaucus, N. J. Used at the end of a tentering-finishing operation, the installation permits speeds of 60 to 120 yd per minute and has paid for itself in a few months.

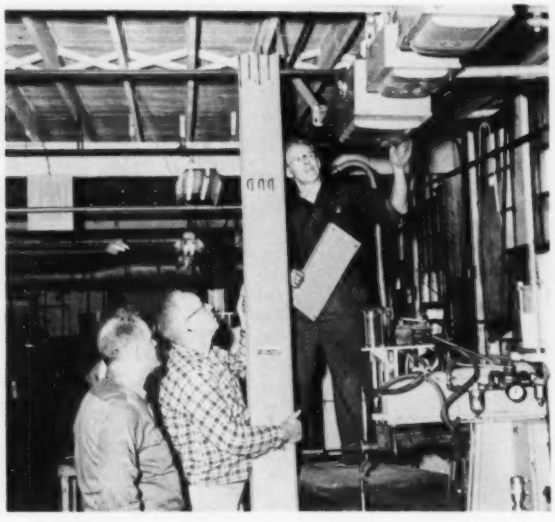
The heating equipment consists of 12 multi-frequency radiation heaters, rated 10 kw each, and operated from a 120-v line. They are mounted only four inches above the fabric to maximize heat transfer. The heating section is extremely compact, measuring only 8 ft long by 6 ft wide, and requires a minimum of installation.

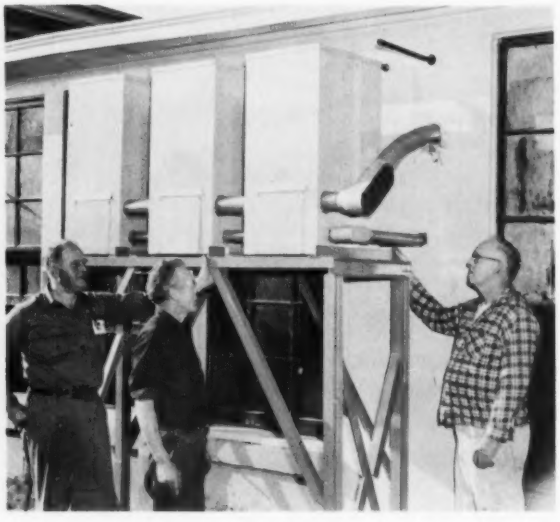
Mounted on the wall near the end of the heating section, the pyrometer monitors the temperature of the fabric as it leaves the heaters.

What's Your Production Problem?

If you have problems in lighting, drying, casting, forging, painting, or materials handling, consult your local power company. Let their experienced specialists show you how to cut costs with electric power.

Cost-Cutting Ideas for Industry





Equipment Relocation Simplified By Plug-In Bus Duct

F. W. RIGGS, Industrial Sales Engineer, The Connecticut Light & Power Co., Essex, Conn.

Relocation of eight 30- to 50-kva spot welders from a branch to the main plant was accomplished with a minimum of expense and disarrangement through the use of plug-in bus duct distribution at the Verplex Co., Essex, Conn., manufacturers of lamp shades and wire products. According to plant officials, "There were no problems, no complications, no headaches. What could have been a troublesome move was surprisingly simple."

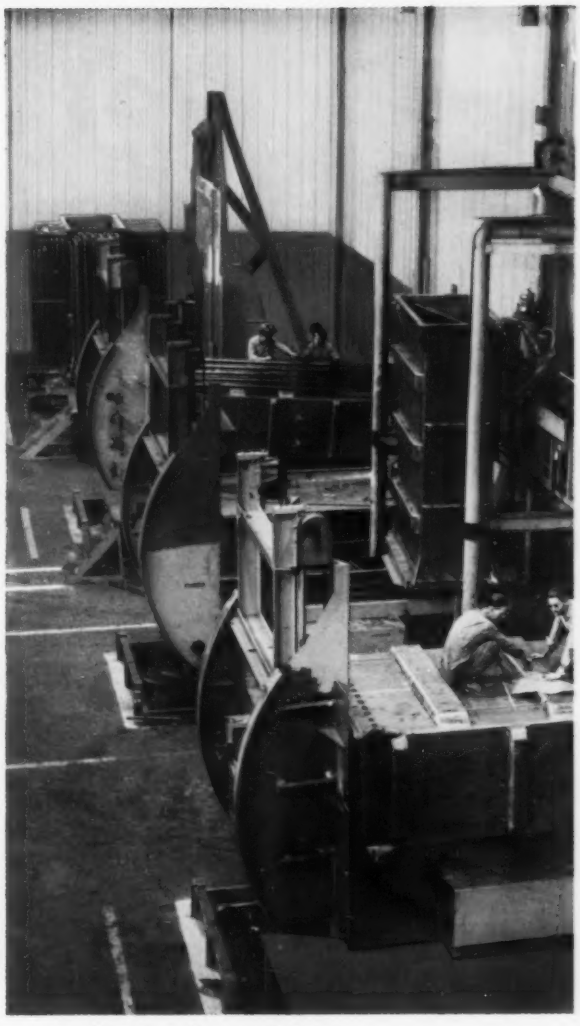
In 12 hours, three men hung seven 10-ft, 400-amp bus duct sections and installed 8 plug-in type fused switches. No time-consuming, individual runs back to remote switchboards were required to put 8 welders in operation. To operate the eight 240-v welders off a 480-v system, plant electricians installed three 37.5-kva dry-type transformers on a rack outside the welding room. A fused switch immediately inside the building isolates the bus duct from the transformer bank and permits movement or displacement of machinery served by the bus at a moment's notice.

Heat Terminal Electrically

GEORGE C. WAGNER, Industrial Sales Engineer, Union Electric Co., St. Louis, Mo.

Efficient intermittent heating for a garage and a space saving installation for the office area are the twin advantages of an electric heating installation used in the new terminal of Southwest Freight Lines in St. Louis. A 5-ton split unit, with outside air handling unit and compressor mounted on the roof to save space, handles the 1,500-sq ft office space. Radiant heaters totalling 18 kw, mounted along one wall, heat the garage which is used intermittently for tire changing and trailer washing. Heaters are on only when the garage is in use. The garage installation influenced the decision to use a heat pump in the terminal office area.

Eliminating "job-shop" fabrication . . .



. . . in favor of repetitive manufacture helps you . . .

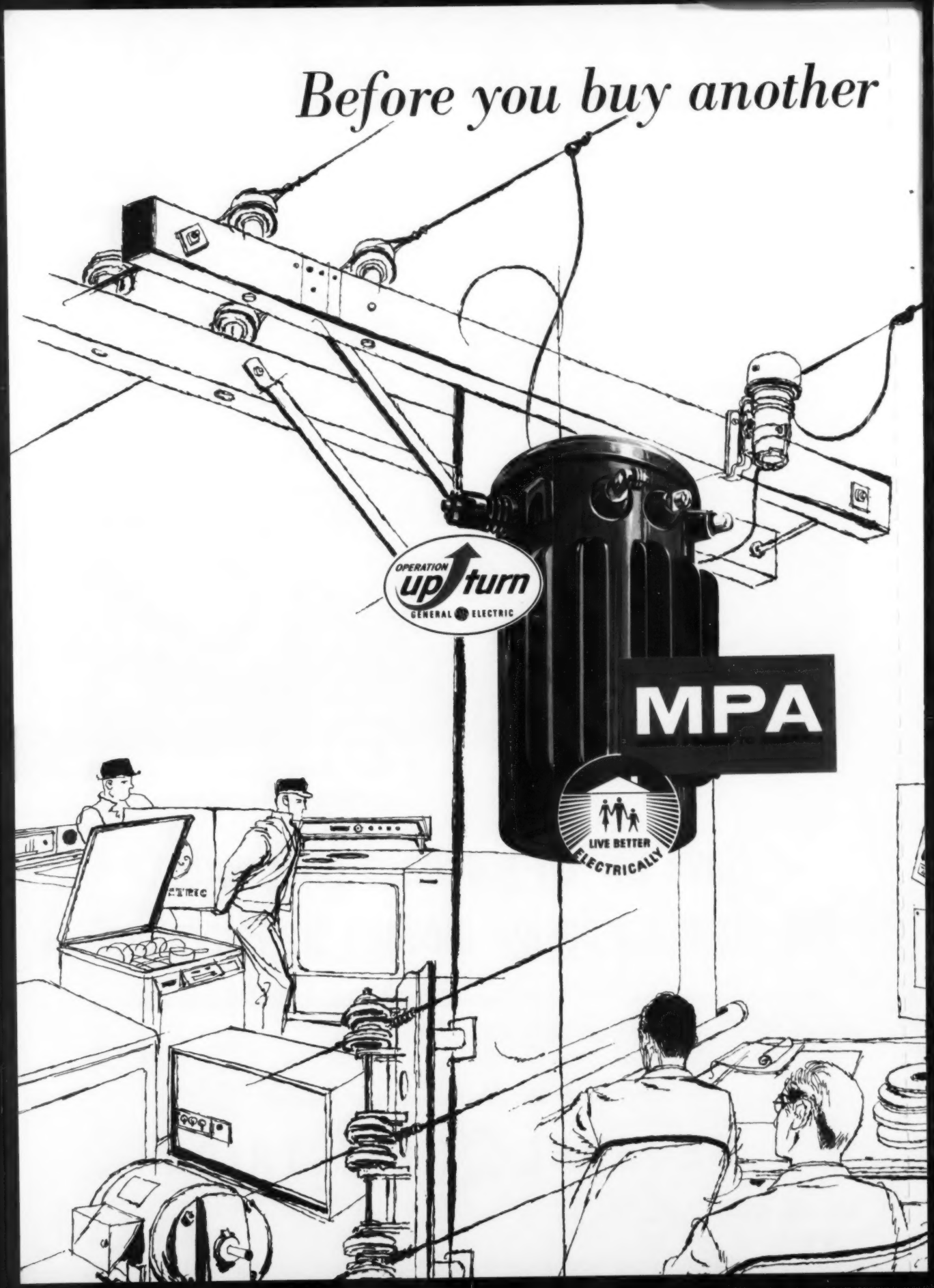
Save 8% on purchase price with RM standard-design medium transformers*

*RM (repetitive manufacture) is the G-E name for standard-design medium transformers (in ratings 501 to 7500 kva, 69 kv and below).

General Electric Co., Schenectady 5, New York. 416-22

Progress Is Our Most Important Product

GENERAL ELECTRIC


Before you buy another
OPERATION upturn
GENERAL ELECTRIC
MPA
LIVE BETTER ELECTRICALLY

transformer... MEASURE LOAD BUILDING

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Progress Is Our Most Important Product

GENERAL ELECTRIC

GIVE YOUR TRANSFORMER MANUFACTURER CREDIT FOR THE EXTRA VALUES HE GIVES YOU		G.E.	OTHER MFGRS.			
MEASURE LOAD BUILDING—do Co.'s other products build load? Does Co. sponsor load-building programs?						
CHECK SERVICE—24-hour shipment? repair and uprating? emergency assistance?						
COMPARE FEATURES—how many exclusive features in terms of longer life; reliability; easy maintenance?						
ANALYZE PRICE—does Co. hold line against inflation with significant product developments?						
EVALUATE INNOVATIONS—has Co.'s research paid off for you? Recent examples?						

FILL IN THE BLANKS . . . See which manufacturer gives you more for your transformer dollar: Mark "X" for a measurable contribution, "O" for insignificant contribution.

Two Procedures for Bonding Potheads

Two methods are illustrated for pothead bonding, with bond located at cable entrance and bond located at potheads. This is an adaptation from distribution standards of New England Electric System.

Bond Located at Cable Entrance

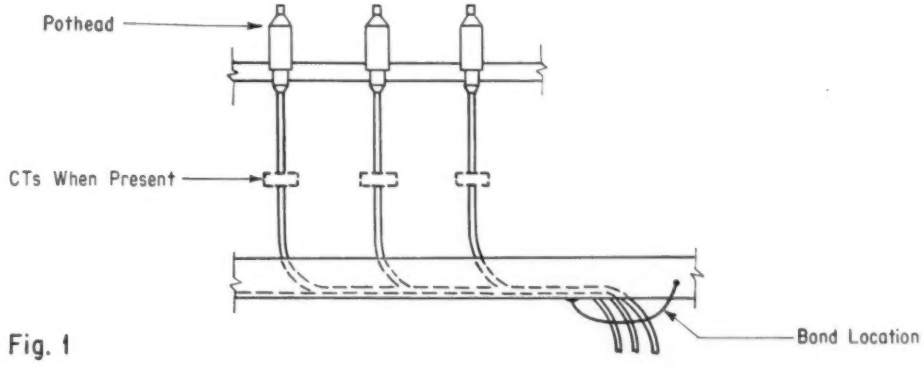


Fig. 1

Method used for all cables when current transformers (CT) are present and for all cables without RN jacket.

Bonding Procedure: Use No. 3 bond wire looped or No. 1/0 single conductor. Connect to grounded steel located nearest to the cable entrance.

Note: When current transformers are present as shown (Fig 1), the potheads and cables shall be free of grounded steel above the transformers.

Bond Located at Potheads

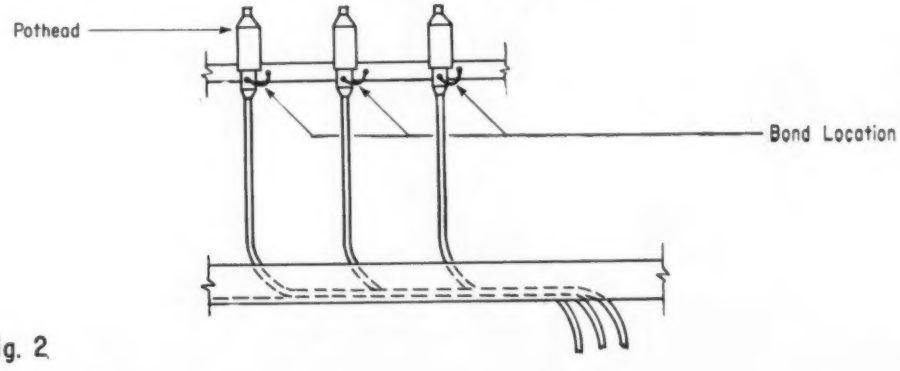


Fig. 2

Method used for RN jacketed cables (except when current transformers are present, then bond as in Fig 1).

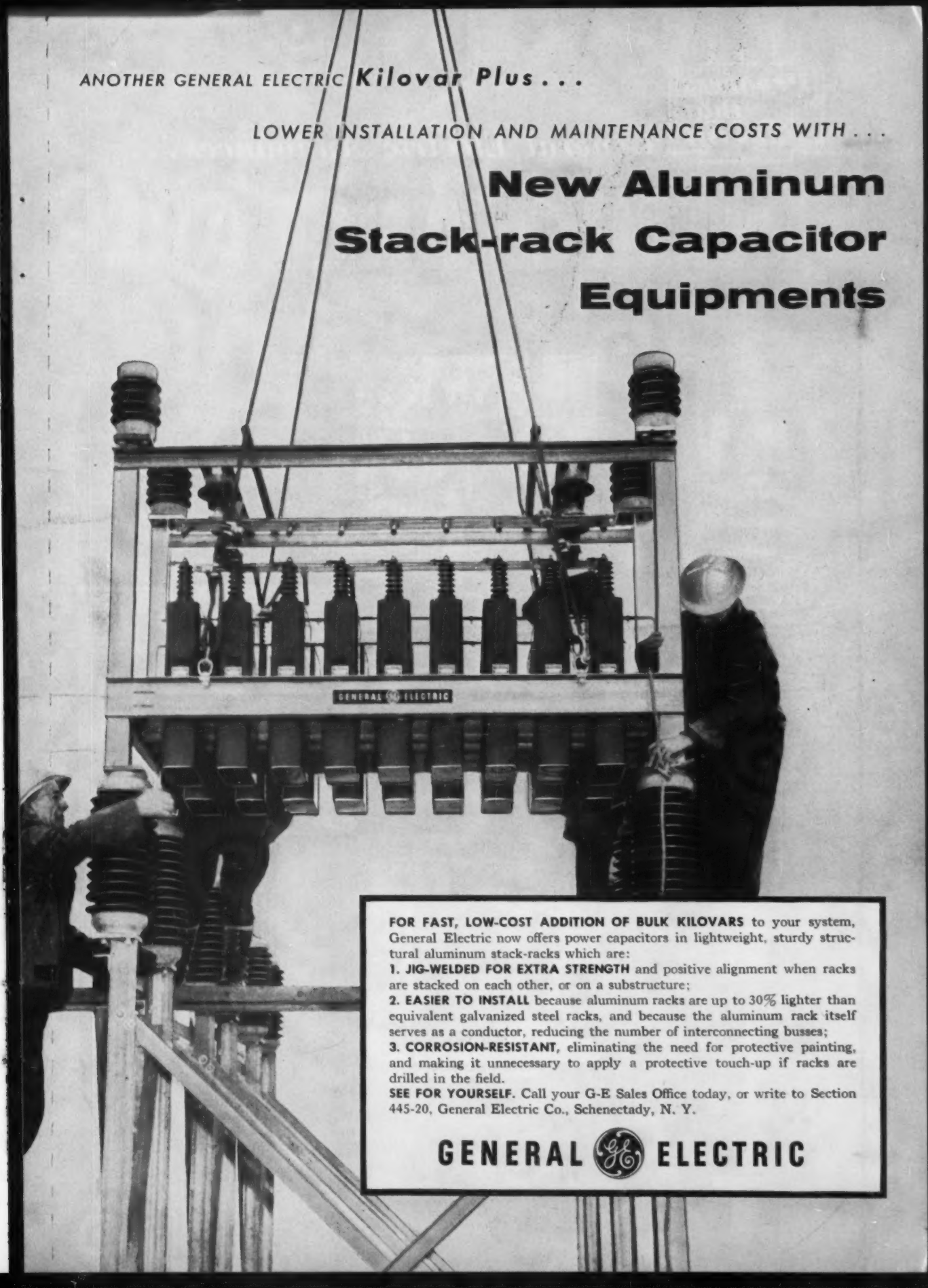
Bonding Procedure: Use single No. 3 bond wire. Connect to grounded steel member or No. 1/0 ground bus under wood member.

Note: When potheads are on wood crossarms, bond as in Fig 2 by extending each No. 3 bond wire to point of connection to down lead of pole ground or to No. 1/0 ground bus under crossarm.

ANOTHER GENERAL ELECTRIC ***Kilovar Plus . . .***

LOWER INSTALLATION AND MAINTENANCE COSTS WITH . . .

New Aluminum Stack-rack Capacitor Equipments



FOR FAST, LOW-COST ADDITION OF BULK KILOVARS to your system, General Electric now offers power capacitors in lightweight, sturdy structural aluminum stack-racks which are:

1. JIG-WELDED FOR EXTRA STRENGTH and positive alignment when racks are stacked on each other, or on a substructure;

2. EASIER TO INSTALL because aluminum racks are up to 30% lighter than equivalent galvanized steel racks, and because the aluminum rack itself serves as a conductor, reducing the number of interconnecting busses;

3. CORROSION-RESISTANT, eliminating the need for protective painting, and making it unnecessary to apply a protective touch-up if racks are drilled in the field.

SEE FOR YOURSELF. Call your G-E Sales Office today, or write to Section 445-20, General Electric Co., Schenectady, N. Y.

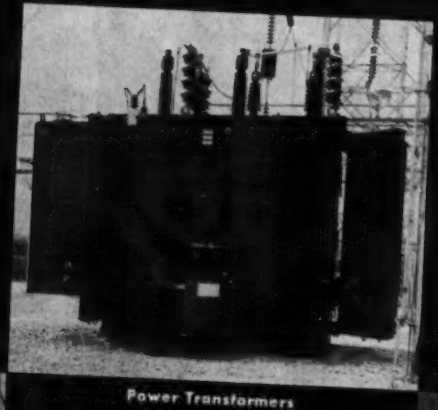
GENERAL ELECTRIC

Progress that Pays Off

General Electric Announces . . .

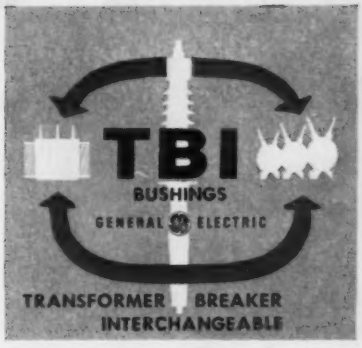
INTERCHANGEABLE

Circuit Breakers



Power Transformers

Medium Transformers



BUSHINGS

8 basic designs 23 kv to 196 kv directly interchangeable between transformers and circuit breakers

How progress in bushings pays off . . .

- You can cut your inventories as much as 75%—these eight basic bushings replace the 37 bushings permitted in latest ASA standards. G.E. estimates $5 million saving to utilities.
- You simplify your stocking and ordering—same bushings fit breakers *and* transformers.
- You help fight price inflation—by manufacturing more of fewer types the savings of volume production help offset mounting costs.

TBI‡ (transformer breaker interchangeable) bushings all incorporate the proved features of G-E Type U design which permits reductions up to 25% in size and weight. An exclusive Rescon* paper core means optimum voltage gradient. Insulating structure is completely oil impregnated and void-free for greater reliability. All bushings are easy to inspect because of convenient liquid level indication even in the smaller ratings.

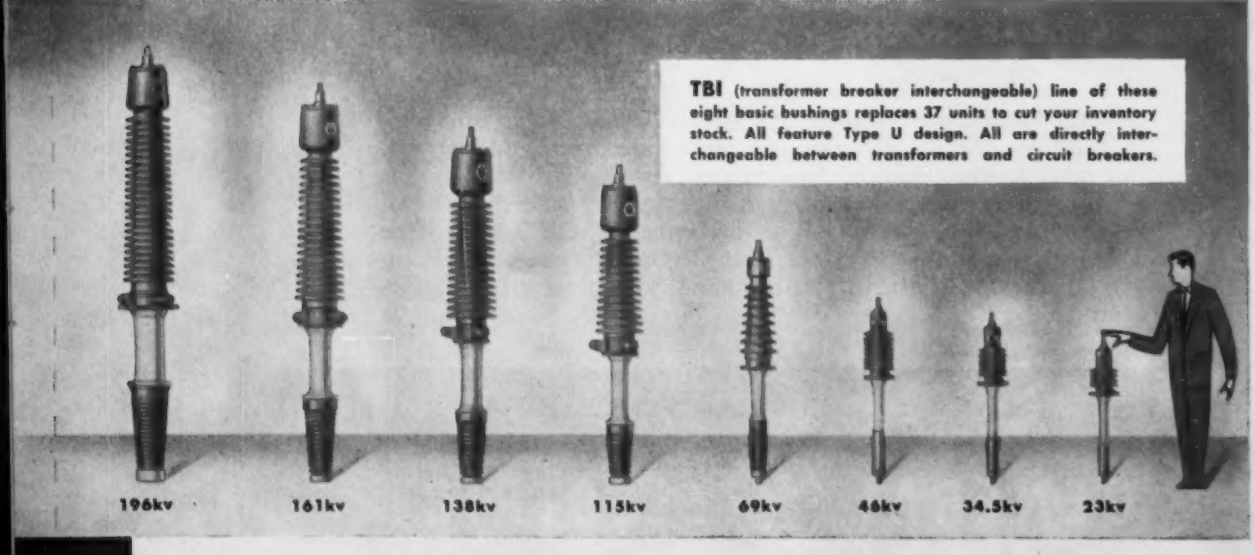
TBI bushings will be available for use on power and medium transformers and circuit breakers after February 1, 1959. For further information contact your local General Electric Sales Office. Section 421-57, General Electric Company, Schenectady 5, N. Y.

‡ Trademark of General Electric Company.

* Rescon—trademark of General Electric Company for a form of semiconductor material.

Progress Is Our Most Important Product

GENERAL ELECTRIC


TBI (transformer breaker interchangeable) line of these eight basic bushings replaces 37 units to cut your inventory stock. All feature Type U design. All are directly interchangeable between transformers and circuit breakers.
196kv
161kv
138kv
115kv
69kv
46kv
34.5kv
23kv

From larger General Electric Gas Turbines . . .

MORE PACKAGED POWER

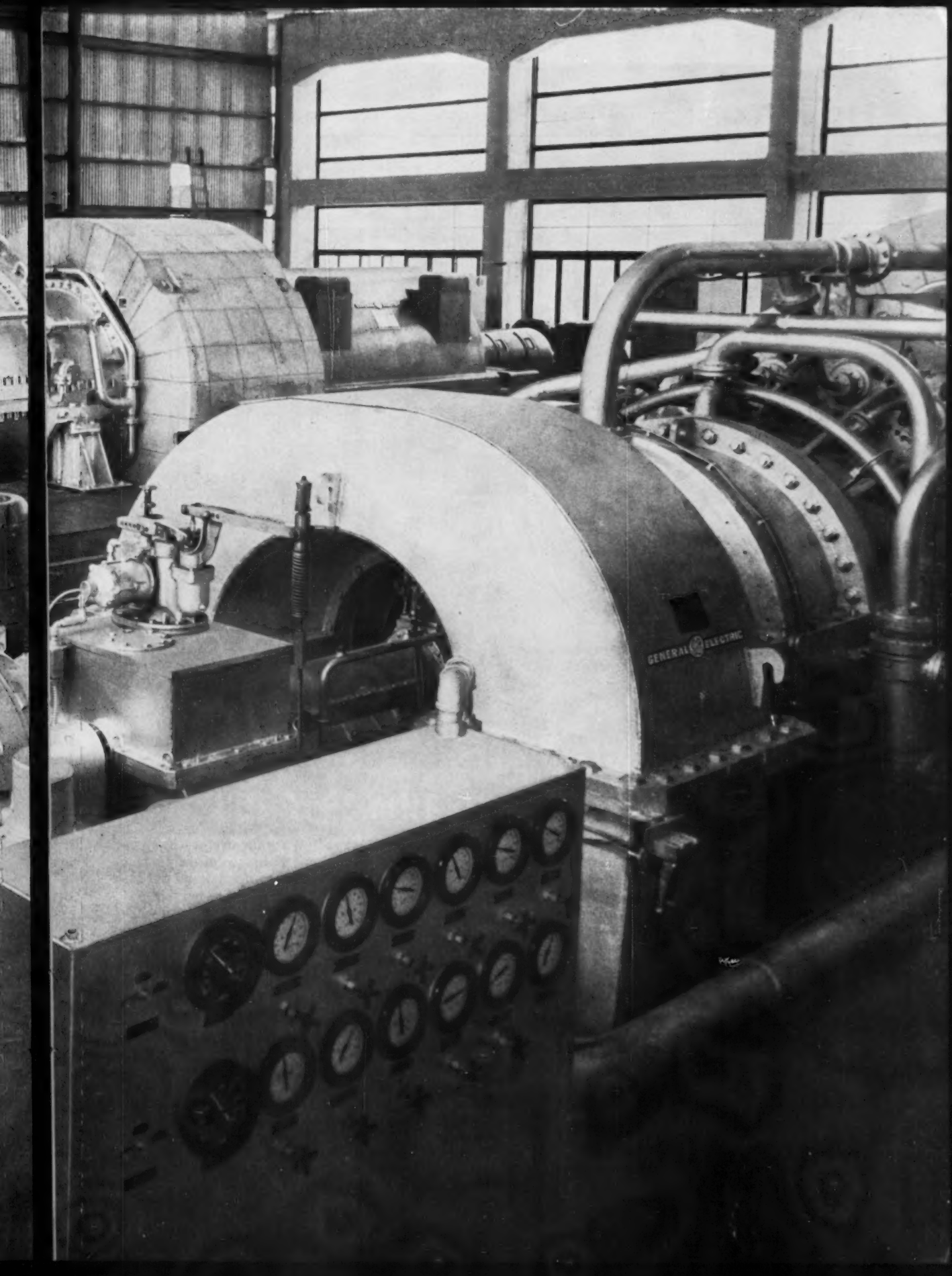
Each of these 16,000-kw General Electric simple-cycle, single-shaft gas turbines has operated more than 6,000 hours since it was installed just over a year ago.

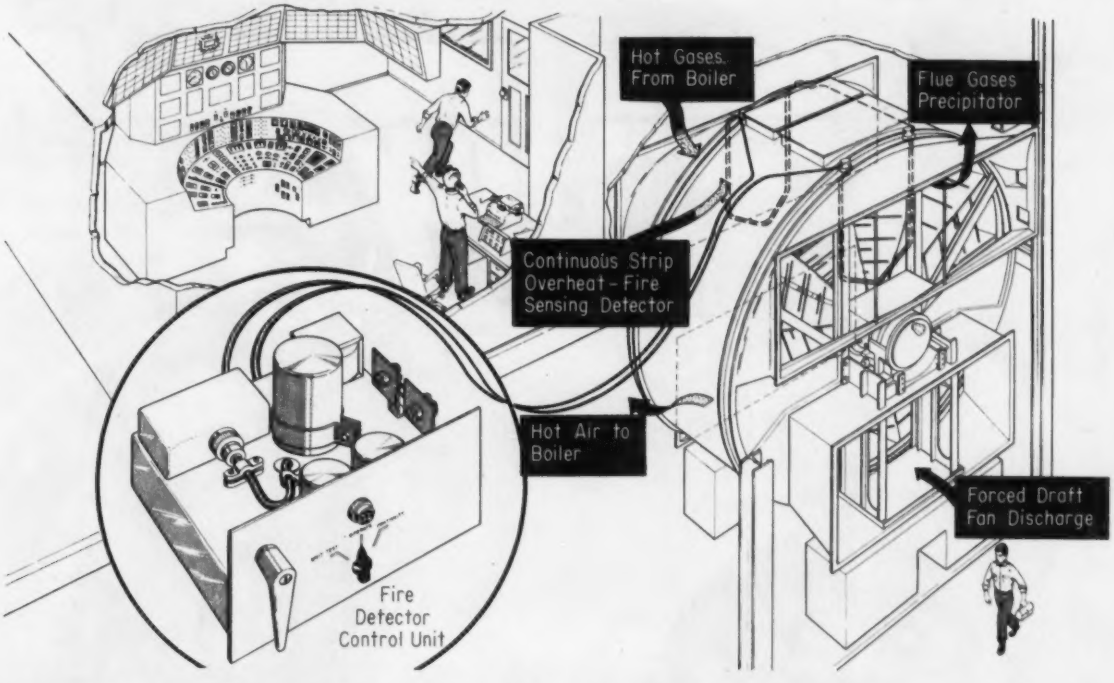
To help lower your power costs, General Electric offers a wide range of self-contained, compact gas turbines from 5,000 to 21,800 kilowatts. Simple- or regenerative-cycle gas turbines are available to suit the economics of the application. Where the easily recoverable exhaust heat can be used for steam generation or in processes, gas turbine cycle efficiencies in excess of 60% can be obtained.

General Electric gas turbines are backed by over two and one-half million operating hours in a wide variety of applications. For more information on the extra values General Electric gas turbines offer your company, contact your nearest General Electric Apparatus Sales office, or write for GED-3546 (Gas Turbines For Industry) or GED-3603 (Gas Turbines For Electric Utilities). General Electric Company Section 261-32, Schenectady, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC


GENERAL ELECTRIC


Hot Gases From Boiler
Flue Gases Precipitator
Continuous Strip Overheat - Fire Sensing Detector
Hot Air to Boiler
Forced Draft Fan Discharge
Fire Detector Control Unit

SENSING ELEMENT consists basically of a ceramic material enclosed in a 0.090-in. outside diameter inconel tube with two wires imbedded at a fixed spacing in it. Elements are capable of responding in the range of 200 to 1,000 F

Control Unit Finds Air Heater Hot Spots

E. N. SCHWALJE, Engineer, Electric Engineering Dept, Public Service Electric and Gas Co, Newark, N. J.

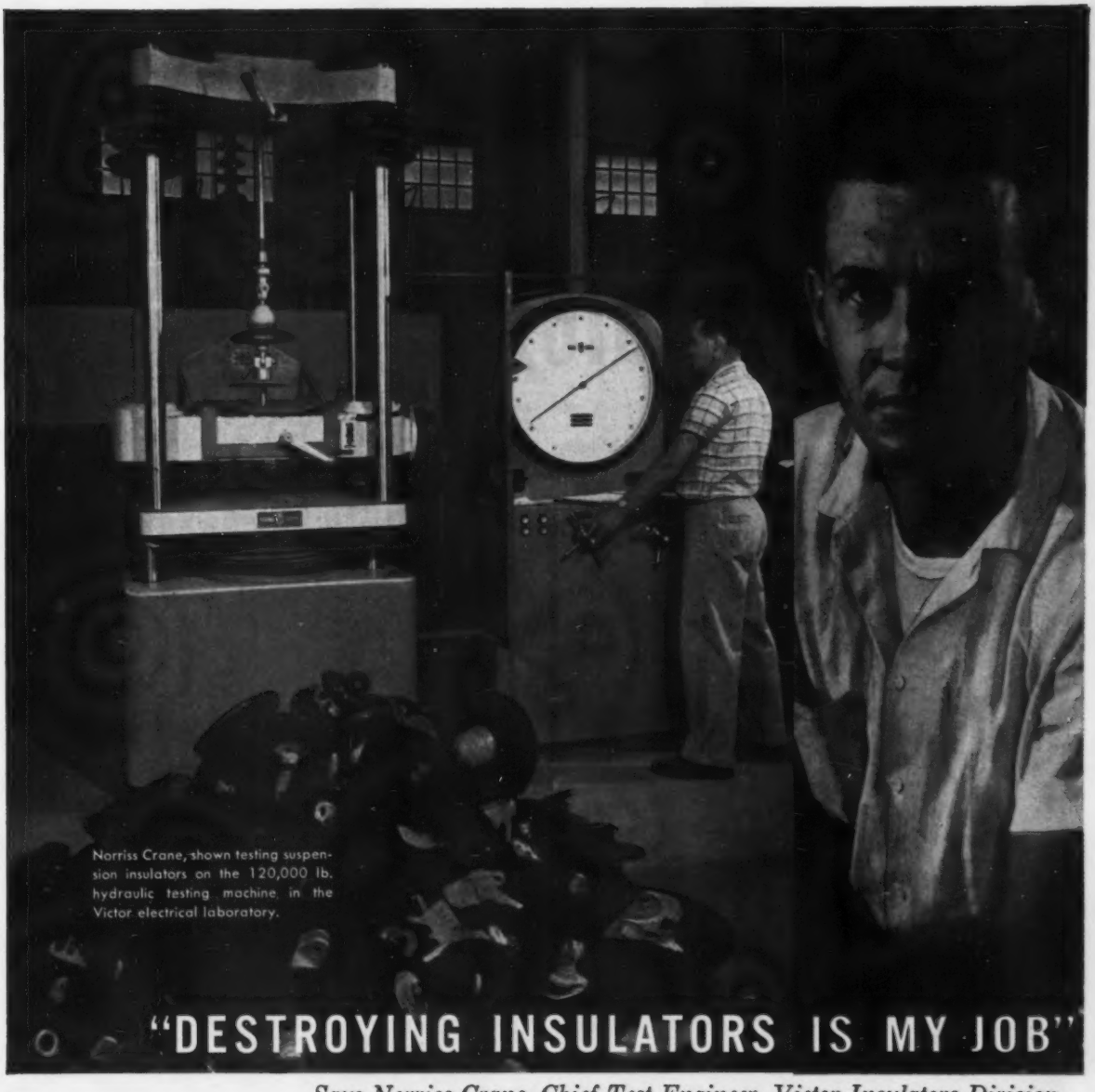
Air heater hot spots can be detected quickly with a wire and ceramic temperature sensing circuit used by Public Service Electric and Gas Co. The device, installed in air heaters of oil fired boilers, scans the entire inlet and outlet rotor surface of the air heater, permitting detection of dangerous temperature changes more quickly than was previously possible.

The element consists of a ceramic material enclosed in a 0.090-in. outside diameter inconel tube with two wires imbedded at a fixed spacing in it. Elements are placed immediately adjacent to the rotor in the form of a pie-shaped sector at both ends of the air heater.

Resistance of the ceramic material decreases exponentially with temperature increase, permitting increased current flow between the wires. One of the wires is grounded to the tube at the fitting at each end, and the other is fixed to insulated center pins mounted in the end fittings. These elements, in lengths up to 20 ft, can be connected to make up to 100-ft circuits and can respond to temperatures over the range of 200 to 1,000 F.

Control units are relay operated but are also available with transistors. The control consists primarily of a Wheatstone bridge, relay, and potentiometer. When the bridge becomes balanced as a result of the decrease in the resistance of the ceramic material due to increased temperature, the current reverses and the alarm relay is closed. When the overheat is eliminated, the resistance of the ceramic core returns to normal and the circuit also is restored to normal.

The control unit will alarm when the temperature surrounding the sensing element reaches a preset level, when any part of the element is exposed to fire, or if power to to the sensing circuit fails. The loop type circuit permits testing continuity with a local test button and light. If the sensing element is severed, operation will continue because power is applied to both ends. A test resistor which simulates the resistance of the sensing element at the alarm temperature is provided as an operating check for the control unit.



Norriss Crane, shown testing suspension insulators on the 120,000 lb. hydraulic testing machine in the Victor electrical laboratory.

"DESTROYING INSULATORS IS MY JOB"

Says Norriss Crane, Chief Test Engineer, Victor Insulators Division, I-T-E Circuit Breaker Company

"The VICTOR insulators that go on your lines will never have to take the mechanical and electrical loading we give them in the VICTOR laboratory. Here, these insulators are subjected to stresses far in excess of the EEI-NEMA Standards. In fact, our continuous quality control testing program shows that VICTOR insulators proof-test at values as much as twice their EEI-NEMA ratings. Such a margin of safety precludes insulator failure on the line."

When you buy VICTOR, you buy practically twice the insulator you pay for. That's why we say: *"VICTOR is the power man's best bargain."*

I-T-E CIRCUIT BREAKER COMPANY, INC.
VICTOR INSULATORS DIVISION
Victor, New York

at last! Here's the KEY to a safe, economical, attractive underground distribution system

RT&E Terra-Tran

LOWER COST!

IMPROVED APPEARANCE!

MUCH SAFER!

UNLIMITED APPLICATIONS!

The new, completely self-contained **TERRA-TRAN** for underground distribution reduces transformer installation costs. No separate enclosures or protective equipment required. Full KVA from transformer — no derating. This means lower cost for the complete underground system.

The new, attractive **TERRA-TRAN** is designed for pleasing appearance, painted to harmonize with the suburban landscape. Unobtrusive, easily camouflaged by shrubbery. Poles and wires are eliminated, enhancing the general appearance of the entire area.

The new, extra-safe **TERRA-TRAN** has all live parts enclosed in a locked, tamper-proof compartment. In addition, special interlock on door prevents entry of foreign objects.

The new, versatile **TERRA-TRAN** transformer is admirably adapted to new suburban residential areas, to shopping centers, to schools and institutions, and to industrial parks. Available in single and three-phase applications.

A

Swinging door provides authorized service access to operating compartment for service personnel only. Door has baffle edge to prevent accidental contact with live parts.

B

Externally operated bayonet type disconnect switch designed for hook stick operation.

C

Externally replaceable bayonet type primary fuse designed for hook stick operation.

D

Features the industry-famous RT&E wound core with high mechanical strength, repairability, light weight, low losses, and low exciting currents.

E

Low voltage bushings externally clamped for easy inspection and maintenance.

F

Extended copper bus provides ample space for terminating multiple secondary leads.

G

Extended copper bus for secondary ground connectons.

H

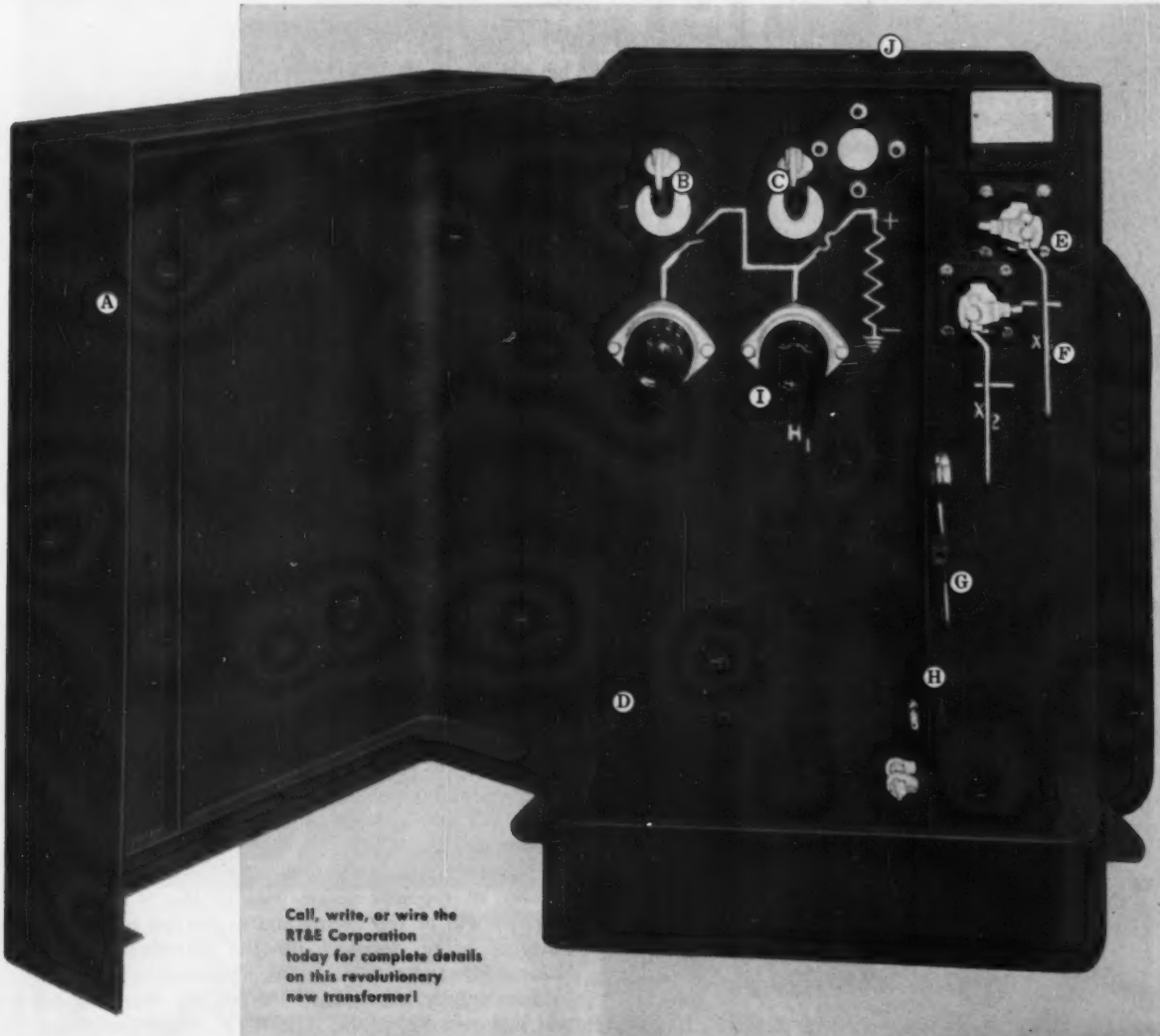
Steel safety divider between high and low voltage sections.

I

Externally-clamped, insulated knob-type high voltage bushings are specially designed for terminating shielded high voltage cable.

J

Tamper-proof cover, arc-welded to heavy gauge steel tank.



Call, write, or wire the RT&E Corporation today for complete details on this revolutionary new transformer!

ENGINEERING TALENT CONCENTRATED ON ONE IDEA — A BETTER TRANSFORMER

RT&E CORPORATION

WAUKESHA, WISCONSIN • PORTLAND, OREGON

Manufacturers News

All-Aluminum Towers Planned by PSE & G, Alcoa

First all-aluminum transmission towers in the U. S. are programmed by Public Service Electric & Gas Co in cooperation with the Aluminum Co of America. The Jersey utility plans to use over 60 such towers on a double circuit, 230-kv line from Hillsborough to North Branch, N. J. Length of the line will be approximately 11 miles. Line construction will start in the fall of 1960 for May '61 completion.

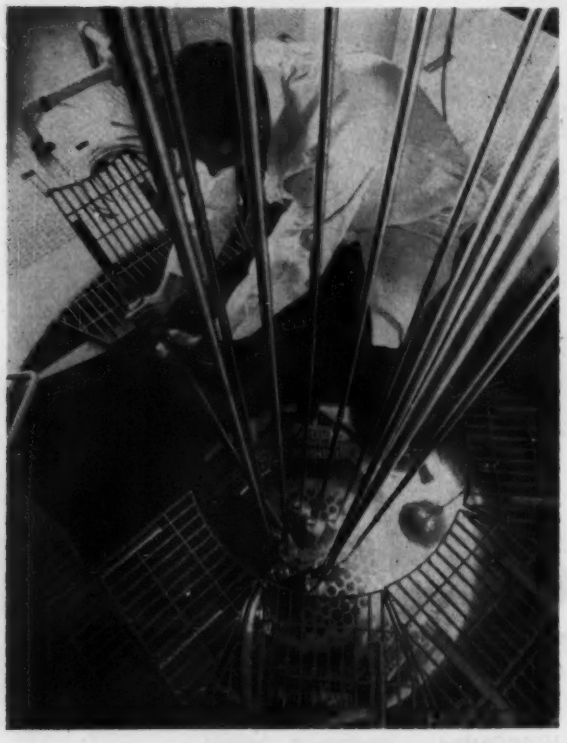
These towers will be standard type structures but completely fabricated from aluminum. Earlier aluminum towers used on the Aluminum Co of Canada's Kemano-Kitimat project (EW, Feb. 21, 1955) were special tubular design.

The towers are being designed to accomodate two 3-phase circuits using 1,590 Mcm, ACSR conductors. They will have two ground wires. Tower height will be about 130 ft and although design has not been finalized it is contemplated that the towers will have the same appearance as steel transmission structures. The same load assumptions considered in steel tower design will be used and spans will average about 1,000 ft.

PSE&G has been investigating the design of aluminum towers since 1952. A company spokesman said the decision to use aluminum structures was a matter of economics with the elimination of maintenance painting a deciding factor.

Westinghouse Test Reactor to be Operated May 1959

A new atomic research "tool"—the Westinghouse Testing Reactor (WTR)—was previewed recently by Westinghouse Electric Corp. At the same time, Dr. William E. Shoupp, technical director of the Westinghouse atomic power department, decommissioned the company's oldest atomic tool—an industrial atom smasher, reportedly the world's first and a prime source of early atomic data.



Edmund T. Morris, manager of the WTR, stated that this new atomic research tool will go into operation next May. The reactor is located on an 850-acre tract near Waltz Mill, Pa. It is a thermal neutron reactor both cooled and moderated by ordinary water.

Primary purpose of the WTR, said Morris, will be to subject materials and nuclear fuels to radiation conditions similar to those encountered in an operating power reactor. It may be used also for the limited production of radioisotopes for industrial and medical uses.

Initial operation of the reactor will be at a power level of 20,000 kw of heat, continued Morris. However, the plant has been constructed to permit operation at any level up to 60,000 kw with some additional equipment and minor building changes.

The WTR core went critical at another experiment station on June 30, 1958. The core is now awaiting installation in the WTR facility.

"One of the first major uses of the WTR," said Morris, "will be the testing and evaluation of the fuel elements being designed for the Carolinas-Virginia Nuclear Power Associates' vertical pressure tube reactor.

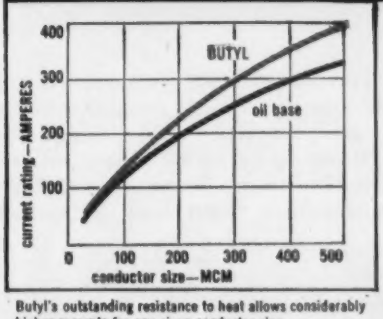
"Incidentally," he added, "the original atom smasher cost just over $250,000. The WTR, when completed, will cost more than $10,000,000."

The picture is a view looking down into a water-filled steel tank and showing the top portion of the nuclear core. Rising above the core are control rod extensions to the drive mechanisms located above. Fuel is enriched uranium in approximately 60 fuel elements.

(More Manufacturers News on page 100)

ENJAY BUTYL

BEST WAY TO HANDLE ELECTRICITY



Butyl's outstanding resistance to heat allows considerably higher currents for any given conductor size.

Of all vulcanizable rubbers, Enjay Butyl offers the best electrical and dielectric properties. Butyl is the ideal material for wire and power cable, transformers, tapes, busbars and other insulation applications.

Butyl *also* offers outstanding resistance to weathering and sunlight . . . chemicals . . . abrasion, tear and flexing . . . superior damping properties . . . unmatched impermeability to gases and moisture.

Find out how this versatile rubber can improve your product. Call or write the Enjay Company, today!

ENJAY® BUTYL

ENJAY *Pioneer in Petrochemicals*

ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y.

Akron • Boston • Charlotte • Chicago • Detroit • Los Angeles • New Orleans • Tulsa

Cobra Co Gets Rights for Pole Preservation Process

The Cobra Co has been organized to take over exclusive U. S. rights to apply the Cobra process of deep-injection preservation of utility poles and other timber products. The process was developed over 25 years ago by the foreign-owned Cobra Impregna of Paris.

Under the agreement signed Nov. 3, Robert G. Duncan became president of Cobra Co and J. C. Strasbourger, executive vice president. Both officers hold similar positions in Mitchell Maintenance Co. Representative of Cobra Impregna were Hugo Peter, president, and S. H. Reece, manager of the British Cobra Co. Headquarters of the new company will be in Muncie, Ind, with an office in New York.

Sales for Third Quarter Reported by Allis-Chalmers

Allis-Chalmers Mfg Co estimates sales for the third quarter of 1958 were $124 million, 7% lower than a year ago. Earnings were $4,929,-106, after deducting preferred dividend requirements for the quarter. This compares with $3,421,866 for a year ago, or 60¢ for 1957 and 42¢ for 1958, on a per share basis.

The company's sales for the first nine months of 1958 amounted to $393,748,854, compared to $419,-354,514 for the same period in 1957. Profits for the first nine months were $13,646,017, compared to $14,829,895 for the first nine months of 1957.

Earnings per share of common stock on 8,216,014 shares outstanding at the end of the period were $1.62. Last year earnings per share were $1.76 on 8,212,774 shares.

Freon Solvent Reduces Motor Cleaning Time, Cost

A solvent called "Freon", made by E. I. du Pont de Nemours & Co, Wilmington, Del., has been found to reduce the cost of cleaning large electric motors about 75%. In addition, the product reportedly does not attack insulating materials and

(Continued on page 102)

99 6% SURE

Of all manufacturers of power capacitors only C-D puts each and every unit through a full voltage energization test before shipment to you. This is why C-D delivers an unbeatable 99.6%-sure performance

PERFORMANCE

in the field.

15, 25, 33.3, 50 and 100 KVAR capacitors for every application with lowest dielectric unit stress and highest major insulation level. Invest your purchasing dollar in internal quality—the only place where it counts. See your C-D representative or write Cornell-Dubilier Electric Corp., Dept. EW-11, South Plainfield, N. J.

SPECIFY

*C*onsistently *D*ependable

CORNELL-DUBILIER

POWER-FACTOR CAPACITORS

CFC

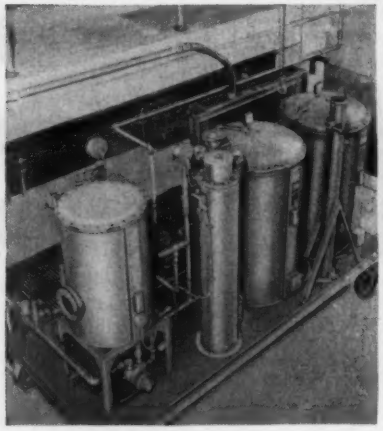
PURIVAC

IS

VERSATILE

CFC Purivac filters, dehydrates and degasifies in one automatic operation — in the field or at central stations.

In the field:
Mounted in a truck, this CFC Purivac is used by Omaha Public Service District to treat all oil-filled electrical equipment at 300 substations. Over 1200 pieces of equipment are served — some located 55 miles from the main plant.



At a central station:
This CFC Purivac reclaims over 200,000 gallons per year of insulating oil for Public Service Company of Indiana.

CFC Purivac is effective, safe, versatile, economical. Write for Bulletin 804 to Department EW.

COMMERCIAL FILTERS CORPORATION
Melrose 76, Massachusetts
Plants in Melrose, Mass. and Lebanon, Ind.

Freon Solvent

(Continued from page 100)

varnishes used on motor windings.

Non-explosive and virtually nontoxic, Freon permits in-place cleaning and makes practical a continuing program of preventive maintenance.

As part of a survey conducted by Du Pont, an application is the cleaning of a 600-hp motor, used to drive a centrifugal refrigeration compressor at Du Pont's Parkersburg, W. Va., plant. In one day, without dismantling and at a cost for the solvent of about $80, the job was accomplished. Previously, using other solvents, the same motor had been cleaned at a cost of nearly $400, including dismantling for shipment to an off-plant cleaning and service site. With Freon, total labor was reduced to 16 hr for readying the motor and reinstalling the coil shields and end bells after cleaning. The cleaning procedure itself required only two hours.

Line Hoods Constructed from Plastic Laminate

Hoods and line tubes are now made from an electrical-grade plastic laminate by Safety Live Line Co, Oakland, Calif. The material is a phenolic-resin, paper-base laminate, known as Grade XX, produced by Taylor Fibre Co, Norristown, Pa., and LaVerne, Calif.

This laminate reportedly has a dielectric strength of 400 vpm, light weight, toughness, good tensile and impact strength, and shape retention. By use of this plastic laminate Safety states that it has practically eliminated production problems, simplified inventory, improved the product and doubled its life.

Hicks Station Uses 8800 Al Louvers

One of the outstanding features of the Hawaiian Electric Co's new Leslie A. Hicks plant is the use of aluminum louvers. These vents or louvers total approximately 21,300 sq ft. They were selected to permit free circulation of air and to provide a water-tight enclosure when needed.

In the opinion of the architects, aluminum was the metal to be used for this application because of its attractive appearance, and because little or no maintenance is required. A total of 8800 louver blades are used in the windows, which range from 61 to 96 ft high, and are 3 to 6 ft wide. The building has windows on three sides.

For this installation in a $10 million investment of a building and initial 50,000-kw turbine-generator, the louvers were made of Kaiser aluminum and fabricated in Honolulu.

...made more useful

by **MACALLEN**

Unfailing stability at high operating temperatures is often the key requirement of MACALLEN Mica . . . in products ranging from toasters to diesel-electric locomotives. With MACALLEN Mica this vital insulating property can be applied in the widest range of shapes and sizes . . . with the greatest efficiency and economy. Solve *your* insulation problem with MACALLEN Mica . . . choice of the electrical industry since 1892. Send for free Catalog 25 today.

MACALLEN MICA

• ALL FORMS • ALL QUANTITIES
• ALL DEPENDABLE

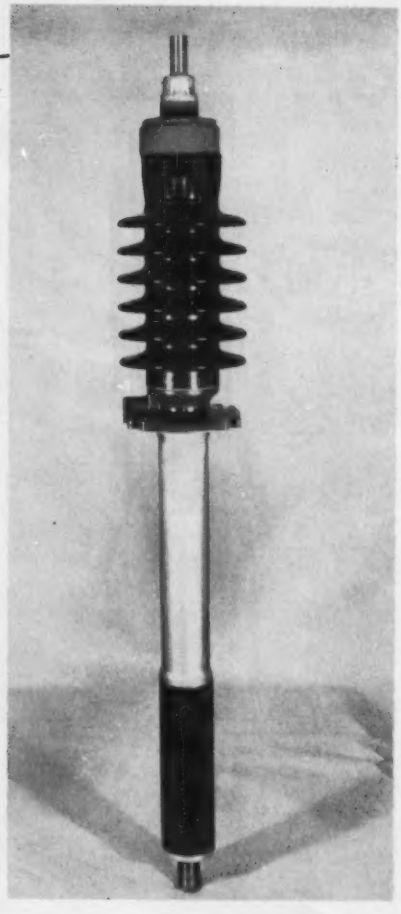
THE MACALLEN COMPANY, INC.

Bay Road, Newmarket, New Hampshire

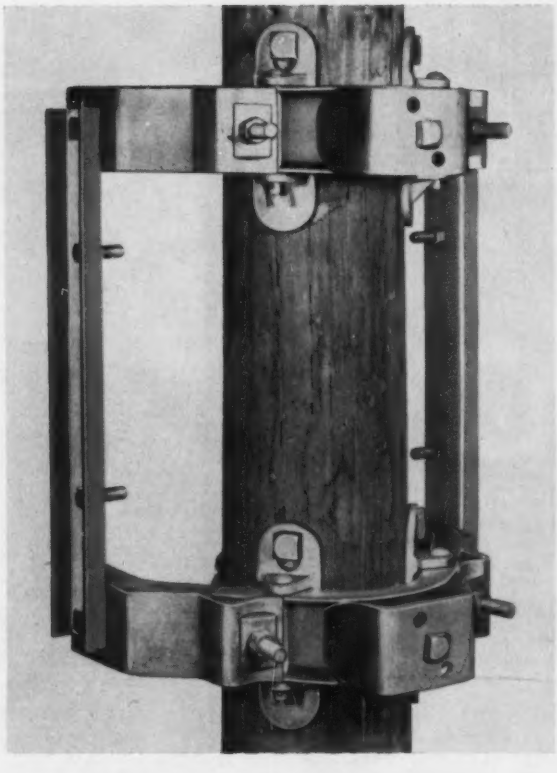
CHICAGO: 565 W. Washington Blvd.
CLEVELAND: 1231 Superior Ave.

New Equipment

Interchangeable Bushings . . .



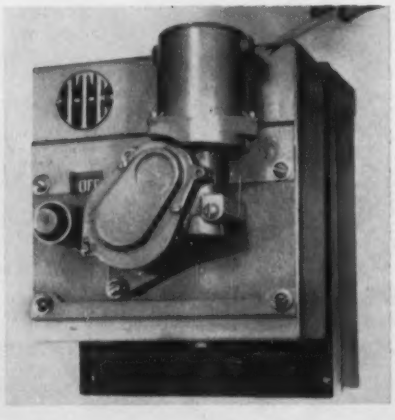
. . . may be used in both transformers and circuit breakers. Only eight basic bushings of the Transformer-Breaker-Interchangeable (TBI) line are required in the standard voltage classes from 23 to 196 kv. For breakers, bushings can be connected at the bottom to the breaker interrupter; in transformers, the draw lead can be pulled up through the hollow conductor and connected at the top. Dual current ratings of 400/1,200 amp in the 23/69-kv range and 800/1,600 amp in the 115/196-kv range are available.
General Electric Co, Schenectady 5, N. Y.



Cluster Mounting . . .

. . . of transformers is aided by pole-band mounting brackets. The brackets simplify installation of one, two, or three single-phase transformers up to 167 kva each. They are adjustable to pole diameters of 7½ to 12 in. and meet EEI-NEMA standards for clearances.
Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wisc.

Remote Control . . .



. . . of molded-case circuit breakers is possible using this mechanism. The motor-operated mechanism can be wired for any operational system desired and can be mounted on either new or existing breakers without removing them from service. The addition adds only 6 in. to the depth of a breaker. It provides electrical actuation in continuous current ratings from 70 to 800 amp and voltages up to 600 v ac and 250 v dc.
I-T-E Circuit Breaker Co, 1900 Hamilton St, Philadelphia 30, Pa.

(*More New Equipment on page* 107)

50,000/66,667 Kva Pennsylvania LTC Transformer at Aurora Station Serves Taconite Mines and Processing Plants Near Duluth

Minnesota Power and Light Chose PENNSYLVANIA

Located at Minnesota Power and Light Company's Aurora Steam Electric Station near Duluth, the 50,000/66,667-kva Pennsylvania Load Tap Changing Autotransformer pictured is meeting all requirements under two extreme operating conditions. They are: widely varying load conditions peculiar to the nearby mines and processing plants of the taconite industry, and wide variations in temperature and weather that are characteristic of this northern state.

By means of 138-kv transmission lines, the transformer ties in the utility's 88,000-kw Aurora Steam Electric Station with the mining company's 150,000-kw Taconite Harbor Steam Electric Station. It feeds into the 115-kv and 44-kv transmission network of the Minnesota Power and Light Company system.

Compensating for load variations are two full-capacity taps in the high voltage and, in the low voltage, LTC equipment for ±10% regulation in 32 steps of $\frac{5}{8}$%. The LTC is designed for future paralleling.

Whether your own transformer requirements include operating extremes or normal conditions, it will pay you to take advantage of Pennsylvania's power-transformer experience. Contact Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

McGRAW-EDISON

PENNSYLVANIA TRANSFORMERS

PENNSYLVANIA POWER TRANSFORMERS

See next page for some facts on facilities

PENNSYLVANIA...

HAS THE FACILITIES AND THE CAPABILITY TO MEET THE LARGEST POWER TRANSFORMER REQUIREMENTS

- A large, expertly-staffed engineering department with long experience in power transformer design—both core form and shell form.
- The ability to design and construct scale models for proving design characteristics.
- A modernly equipped plant capable of producing and testing the highest rated units contemplated by industry today.
- Handling and loading facilities that permit full utilization of manufacturing, shipping and installation economies.

PENNSYLVANIA'S NEW THOMAS A. EDISON ACOUSTICAL RESEARCH LABORATORY

Located in a seven-acre area adjacent to Pennsylvania Transformer's Canonsburg plant, this super-quiet structure has complete facilities for testing and analyzing transformer noises. Vibrations are "plotted" so that the sources of noise can be pinpointed. This permits corrective measures in current production and also points the way to more effective design. In the photographs, acoustical measurements are being taken on a 10,000-kva transformer. Transformers even larger than 100,000 kva, in certain voltage classes, can be tested in the new laboratory.

McGRAW EDISON

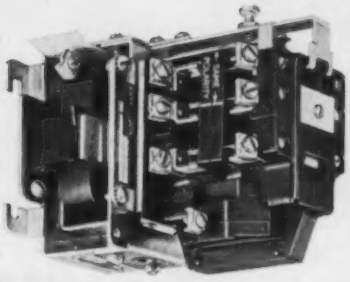
PENNSYLVANIA TRANSFORMERS pt

PENNSYLVANIA TRANSFORMER DIVISION

McGraw-Edison Company

CANONSBURG, PENNSYLVANIA Greater Pittsburgh District

See other side for story of power transformer ruggedness



Control Relay . . .

. . . is mechanically held and may be mounted in the same space as electrically held relays. Both mechanically held and electrically held relays can be mounted on the control panel in the proper sequence as they appear on the elementary diagram. Rated at 10 amp, 600 v, relays are available in a variety of units up to ten contacts.
Square D Co, 4041 N Richards St, Milwaukee 12, Wisc.

Conduit Couplings . . .

. . . facilitate rapid, economical installation. The factory-installed plastic couplings have the same outside diameter as the fiber conduit. Couplings are available on Permaline conduit in 5, 8, or 10-ft lengths and diameters of 2, 3, 4, 4½, or 5 in. Conductors may be installed or stored vertically without staggering the joints.
Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.

Pressure-Sensitive Tape . . .

. . . can be used to hold and insulate between —50 and +180 C. Totally inorganic, "Scotch" No. X-1060 tape consists of a 0.004-in. woven glass cloth backing saturated and coated on one side with silicone rubber, and on the other with a silicone thermosetting pressure-sensitive adhesive. Dielectric strength is 7000 v, insulation resistance 7500 megohms, and tensile strength 150 lb per in. Arc, ozone, and corona resistance are "good",

(Continued on page 110)

What a line . . .

CF&I GALVANIZED STEEL STRAND

Where overhead distribution lines must cover long spans, or in areas where high velocity winds and adverse weather impose a severe strain on power poles, dependable guying is a must.

To provide safe installation and long, trouble-free service life, ground crews prefer CF&I Galvanized Steel Strand. It is made of steel with exactly the right chemical and physical properties to assure high strength and easy workability. The wire is carefully drawn, stranded, cleaned and galvanized with a tightly-bonded coat of pure zinc to produce a corrosion-resistant finish that won't flake, even when severely bent.

CF&I Galvanized Steel Strand meets or exceeds ASTM Specification A-122 or A-363, and is made in a seven- or three-wire construction to meet your specifications. Your nearby CF&I representative or local electrical distributor can give you complete details. Call him today.

GALVANIZED STEEL STRAND
THE COLORADO FUEL AND IRON CORPORATION

THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise • Butte • Denver
El Paso • Ft. Worth • Houston • Kansas City • Lincoln • Oklahoma City • Phoenix • Pueblo • Salt Lake City • Wichita
PACIFIC COAST DIVISION—Los Angeles • Oakland • Portland • San Francisco • San Leandro • Seattle • Spokane
WICKWIRE SPENCER STEEL DIVISION—Atlanta • Boston • Buffalo • Chicago • Detroit • New Orleans • New York • Philadelphia
CF&I OFFICES IN CANADA: Montreal • Toronto • CANADIAN REPRESENTATIVES AT: Calgary • Edmonton
Vancouver • Winnipeg
5904-A

Representative steps in pulverizer disassembly shown here demonstrate ease and safety of maintenance. Access doors are opened by impact wrenches. Doors are swung back, not removed.

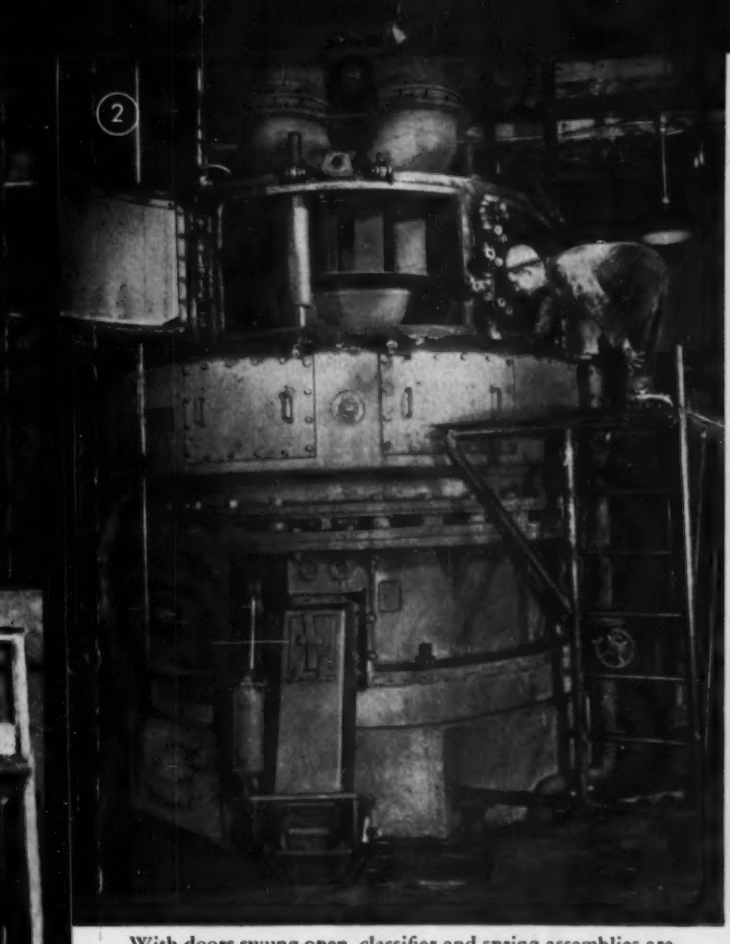
B&W Pulverizer Design Simplicity Cuts Maintenance

Compact Units Handle Low Grade Wet Coal Without Capacity Loss

Exceptional output and efficiency records... highlighted by low maintenance... have been established in hundreds of installations by B&W Pulverizers. Their long-range dependability has been accompanied by reduced operating costs.

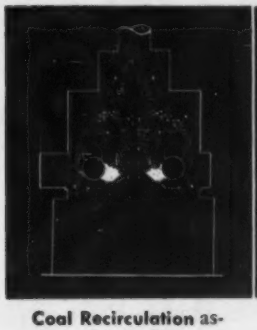
Fan Maintenance Minimized, shutdowns and maintenance costs reduced because the B&W Pulverizer primary air fan operates with only clean air. As primary air is supplied to the pulverizers under pressure, the fuel piping from pulverizer to burners is greatly simplified.

Continuous High Fineness, without reduction in capacity, is assured as grinding surface is maintained with wear. Slow-speed, spring loaded, ball bearing

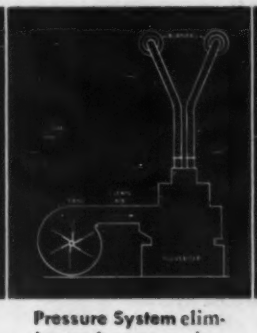


With doors swung open, classifier and spring assemblies are readily accessible for removal. Grinding components are lifted without special rigging.

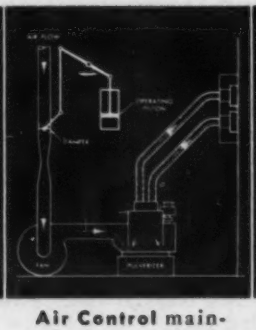
Top grinding ring is lifted by chain falls and, following removal of scaffolding, lifted and transferred by fork lift truck. Lower grinding ring is removed in same simple manner.



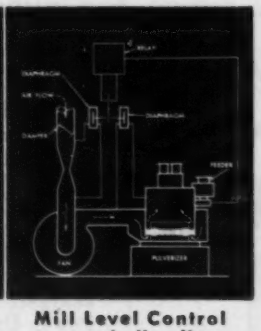
Coal Recirculation assures high fineness, aids drying.



Pressure System eliminates fan wear, simplifies piping.



Air Control maintained at one, simple contact point.



Mill Level Control automatically adjusts fuel-feed.

grinding elements of long-wearing, special alloy material maintain this proper grinding contact throughout their service life. Dependable classification permits only material of proper fineness to leave the unit.

Low Grade Coal, even wet coal, is handled efficiently. Exclusive B&W recirculation of fuel through heated air assures complete grinding, eliminates shutdowns, loss of capacity, and special attention from operators.

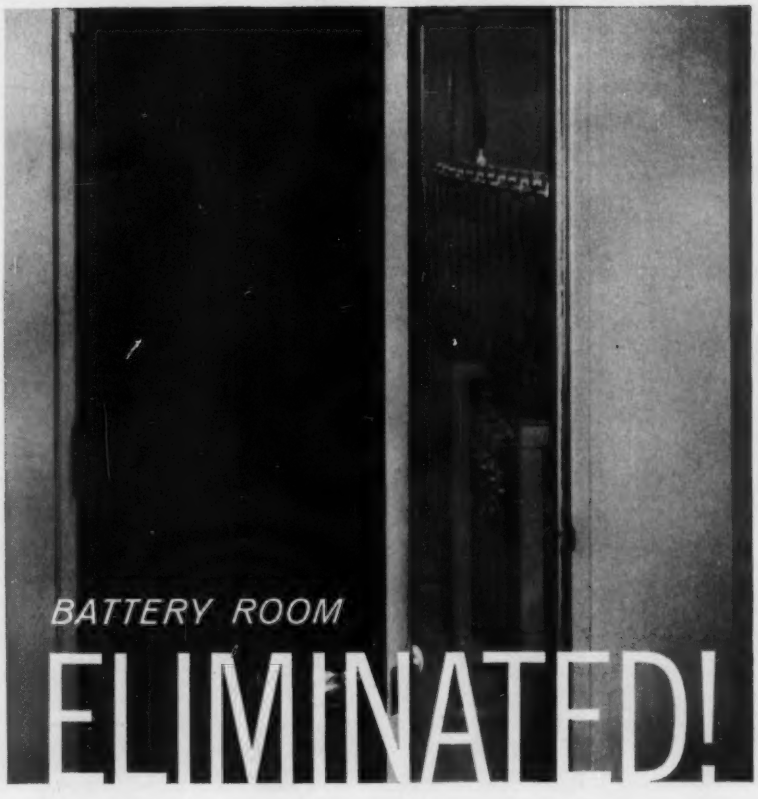
One-Point-Contact with the boiler simplifies operation. Boiler's automatic combustion control connects to the pulverizer at the damper in the primary-air duct. The unit's own control system regulates all other functions.

Continuous, Intensive Development by B&W engineers has brought excellent and measurable results to users of B&W Pulverizers. Supported by a national network of plants and engineers, B&W Pulverizers and Pulverized-Fuel Firing Systems open new avenues to operating economy. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

BABCOCK & WILCOX

BOILER DIVISION

G-844

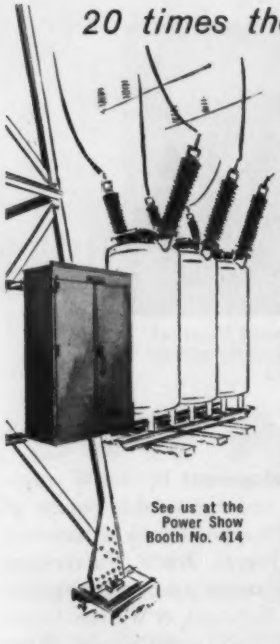


BATTERY ROOM

ELIMINATED!

Non-gassing Gulton Power Units deliver

20 times the punch, take 1/20 the space



See us at the Power Show Booth No. 414

POWERED by the world famous Voltabloc *sealed* nickel cadmium battery, the Gulton Power Unit delivers the punch needed for closing and tripping breakers and switchgear—yet takes only a fraction of the space needed by other DC Sources.

Reason for this is the patented sintered plate construction of the sealed Voltabloc battery and its compact specially designed automatic charger. Not only do these give the Gulton Power Unit exceptional electrical characteristics, but they provide additional benefits as well.

Maintenance, for example, and installation costs are eliminated. Since Gulton units are non-gassing as well as small in size, they can be installed right next to equipment with a minimum of wiring—sometimes even within it!

Our field engineers will be happy to help you pick the right unit for the job. For more information on how "BC" Power Units can help save space, maintenance and money—write for Bulletin No. GPU.

ALKALINE BATTERY DIVISION

Gulton Industries, Inc.

Metuchen, New Jersey

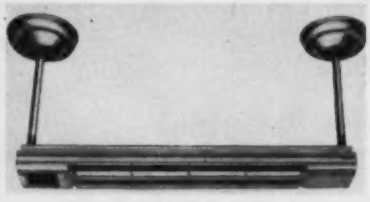
GI

Pressure Sensitive Tape . . .

(Continued from page 107)

and solvent resistance after thermosetting is "excellent" as measured by the manufacturer. Expected uses are coil and support ring, slot, and armature coil insulation, and similar applications in coils, transformers, and relay solenoids.

Minnesota Mining and Manufacturing Co, 900 Bush St, St. Paul, Minn.



Radiant Heater . . .

. . . is ceiling mounted. Suitable for general application, it is ideal for hard-to-heat spots, particularly where overall room temperature cannot be maintained. Designated Type SKR, the heater is equipped with two fixture stems which provide minimum 12-in. spacing below combustible ceilings. It is available in six heater lengths; 16½, 22¾, 38½, 55⅜, 65¼ and 78 in.; with corresponding ratings of 800, 1,100, 1,800, 2,500, 3,000 and 3,600 w for operation on all standard voltages.

Edwin L. Wiegand Co, 7500 Thomas Blvd, Pittsburgh 8, Pa.

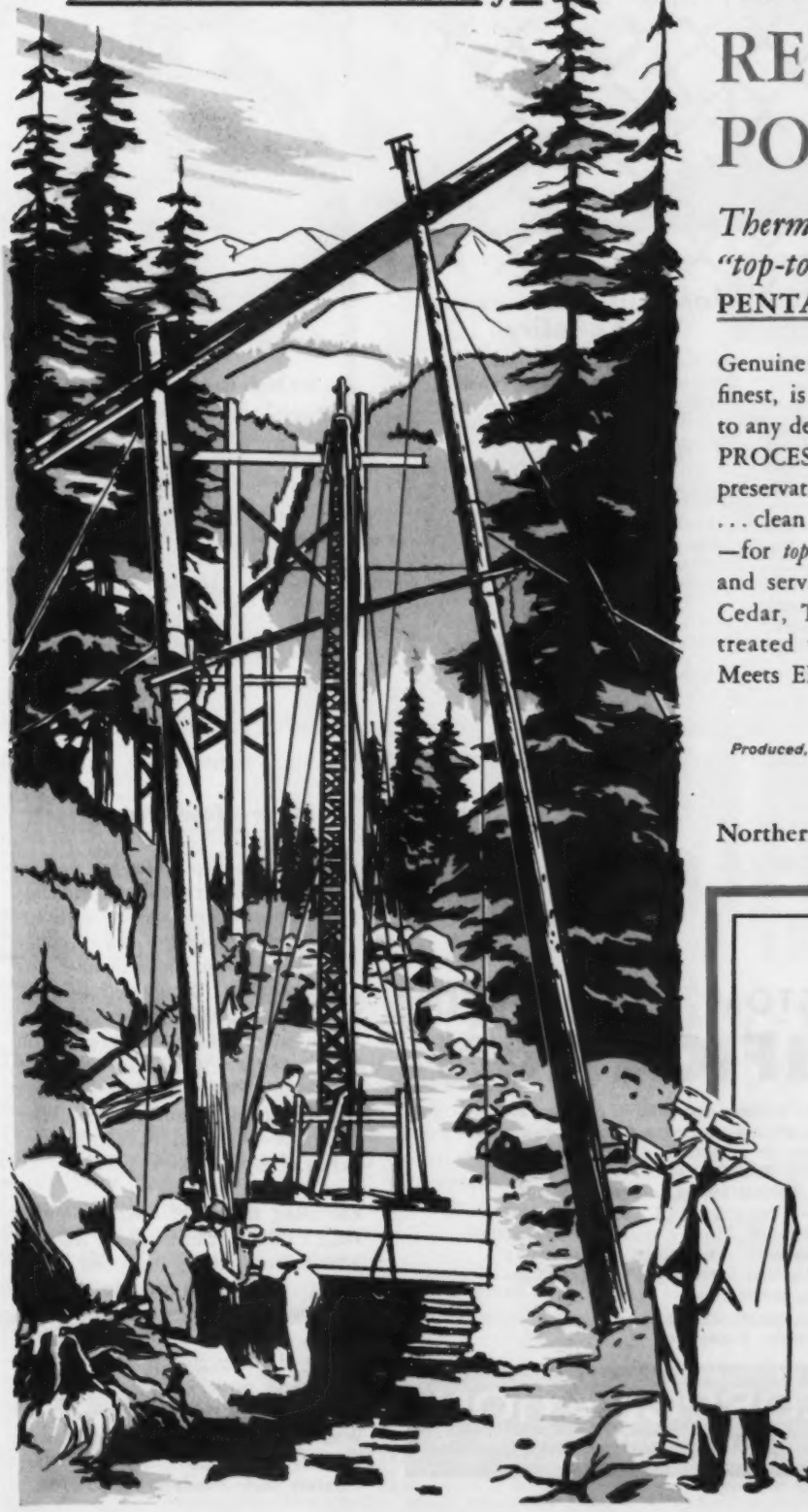
Silicon Rectifier . . .

. . . is cooled by water. It is designed to provide either regulated or unregulated d-c power for steel, electrochemical, plating, and other continuous processing lines. It employs saturable reactor-amplistat control to maintain the desired current level within ± 1% with unit efficiencies from 90 to 95%. Available in ratings of 1,000 to 10,000 amp at voltages up to 300 v, the rectifier may be either manually or automatically controlled by the reactor which provides stepless control from 10 to 125% current output.

General Electric Co, Schenectady 5, N. Y.

(More New Equipment on p. 112)

There is no substitute for . . . . . WESTERN RED CEDAR POLES



Thermal Process treated, "top-to-butt" with PENTAchlorophenol

Genuine Western Red Cedar, nature's finest, is made immune "top-to-butt" to any deterioration by the THERMAL PROCESS with PENTAchlorophenol preservative. Uniform . . . lightweight . . . clean to climb . . . safer . . . straighter —for *tops* in pole quality, appearance and service life specify Western Red Cedar, Thermal Process full-length treated with PENTAchlorophenol. Meets EEI and AWPA specifications.

Produced, Treated and Shipped by the following

Western Red
AND
Northern White Cedar Association
MEMBERS

BELL LUMBER & POLE CO.
MINNEAPOLIS 1, MINNESOTA

B. J. CARNEY CO.
MINNEAPOLIS 3, MINNESOTA
AND
SPOKANE 1, WASHINGTON

CEDAR SERVICE, INC.
MINNEAPOLIS 40, MINNESOTA

R. G. HALEY CO.
TOLEDO 4, OHIO

JOSLYN MFG. & SUPPLY CO.
CHICAGO 6, ILLINOIS

MacGILLIS & GIBBS CO.
MILWAUKEE 9, WISCONSIN

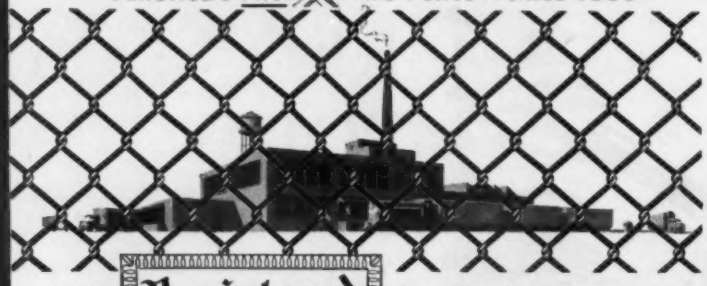
PAGE & HILL, INC.
MINNEAPOLIS 3, MINNESOTA

SCHAEFER-HITCHCOCK CO.
SANDPOINT, IDAHO

VALENTINE CLARK CORPORATION
ST. PAUL 8, MINNESOTA

PAGE chain link FENCE

America's First Wire Fence—since 1883



NOW Registered for double assurance of quality

—Another Progressive Step by PAGE!

• Top quality of materials has always been a distinguishing feature of PAGE Chain Link FENCE. This well-known value plus PAGE standards of workmanship in fence erecting by members of the Page Fence Association have given continuing assurance of reliable protection and good appearance. Now another forward step adds to value certainty. Each newly erected fence will be identified by a PAGE "REGISTERED" metal plate and a dated, numbered and signed Registration Certificate will be given to the owner. Registration of your new Page Fence and certification of its quality are assurance of long, dependable service and lasting satisfaction.

PAGE will help you to choose the RIGHT fence for YOU from a wide variety of fence styles and four superior fabric materials—including the new ACCO Aluminized Fabric. For information and name of nearest Association member, write for Folder DH-26.

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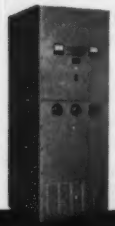
A PRODUCT OF PAGE STEEL & WIRE DIVISION, AMERICAN CHAIN & CABLE COMPANY, INC

BALANCED

Sel-Rex®

CUSTOM ENGINEERED RECTIFICATION

- *Germanium*
- *Silicon*
- *Selenium*



No more tedious matching of cell characteristics when replacing a damaged semiconductor in a rectifier system. Sel-Rex Balancing Reactors *force even distribution of the load among all rectifying elements* — regardless of individual cell characteristics. Simply replace damaged elements with ones which are similarly rated. Another example of Sel-Rex "Custom-Engineering."

Send for FREE "GUIDE" to Industrial Rectifier Equipment.

Rectifier Division

SEL-REX CORPORATION

NUTLEY 10, NEW JERSEY — Representatives in Principal Cities

"Complete Semiconductor Power Conversion Systems for any AC to DC application."

Lighting Units . . .

. . . for high bay installation of mercury and incandescent lamps are now available. Both direct and uplight types are furnished in aluminum or white porcelain enamel. The totally direct type shown is equipped with SuperLOK socket head assembly which permits quick removal of reflector for servicing. Sizes are provided for 300 to 1,000 watt lamps.

Steber Manufacturing Co, Broadview, Ill.

More New Products

D-c 42-frame fhp **motor** has cast-in terminal box that facilitates installation wiring with no change in overall length of motor. Steel cover plate seals connections against dirt and moisture. Designated BC 26, of compact cast iron construction, it has large internal fan pressed on the armature shaft for effective ventilating action. Ball bearings and brush mechanism are rubber mounted.—General Electric Co, Schenectady 5, N. Y.

Elevating tailgate for loads lighter than 2,000 lb can be used for any vehicle from pickup to 3/4-or 2-ton trucks with stake or fan bodies. Electric-hydraulic weightlifter has 1,000, 1,100 or 1,300-lb capacity. Power platform closing on the vertical riding position is standard on 1,100 and 1,300 models.—H. S. Watson Co, 1316 67th St, Emeryville 8, Calif.

(More New Products on p. 116)

1 RATIO AND POLARITY TEST. The standard ASA ratio test to which we subject the coil and taps of every Delta-Star Distribution Transformer determines the precise turn ratio of primary and secondary windings, and can detect even a single-turn error. Polarity is checked at same time.

2 EXCITATION-LOSS AND IMPEDANCE TEST. On instruments accurate to within .75%, each assembled unit undergoes rigid tests in these categories. Strict quality control throughout manufacture assures you a transformer of maximum efficiency and working life. Actual impedance appears on nameplate to nearest tenth of one percent.

3 IMPULSE TEST. This *special* dielectric test, included as a further guarantee of Delta-Star Transformer quality, impresses a standard 1½ x 40 wave on each primary lead at the basic impulse level of the highest rated voltage. An oscilloscope monitors the test, retaining impulse images for critical observation and/or photographing.

4 INSULATION - POWER - FACTOR TEST. A Delta-Star exclusive. Once regarded only as a power-transformer test, this is given to each Delta-Star Distribution Transformer, regardless of rating, as an extra assurance of maximum operating life and freedom from the faults that might cause service interruption and early need for repairs.

5 APPLIED-POTENTIAL AND CORONA TEST. Here again, Delta-Star puts its distribution transformers through tests that no other manufacturer uses. The Corona Detector Test shown above employs the most sensitive equipment available to assure absence of rf interference at operating voltages. The applied-potential test is made at the same time.

6 INDUCED-POTENTIAL TEST. Another standard ASA dielectric test, in which a 400-cycle voltage is impressed across full windings. Started at zero, the voltage is brought to full value in less than fifteen seconds. After eighteen seconds, the voltage is returned to zero in less than five seconds.

EXCLUSIVE! EVERY DELTA-STAR TRANSFORMER passes all six of these tests . . . and more

These are regular production-line tests at Delta-Star —not merely spot checks—that help assure the consistent high quality of Delta-Star Distribution Transformers in every EEI-NEMA rating up to 167kva. These rigorous tests are only one important reason why you should investigate the merits of Delta-Star Transformers—to provide your community with maximum uninterrupted service during normal and extraordinary conditions.

FREE CATALOGS. Complete specifications are given in two new Delta-Star Distribution Transformer catalogs. For your copies, write *Dept.* 148, *Delta-Star Electric Division, H. K. Porter Company, Inc., 17th & Cambria Streets, Philadelphia 32, Pa. District offices in principal cities.*

AND *EXTRA* TESTS FOR EXTRA QUALITY!

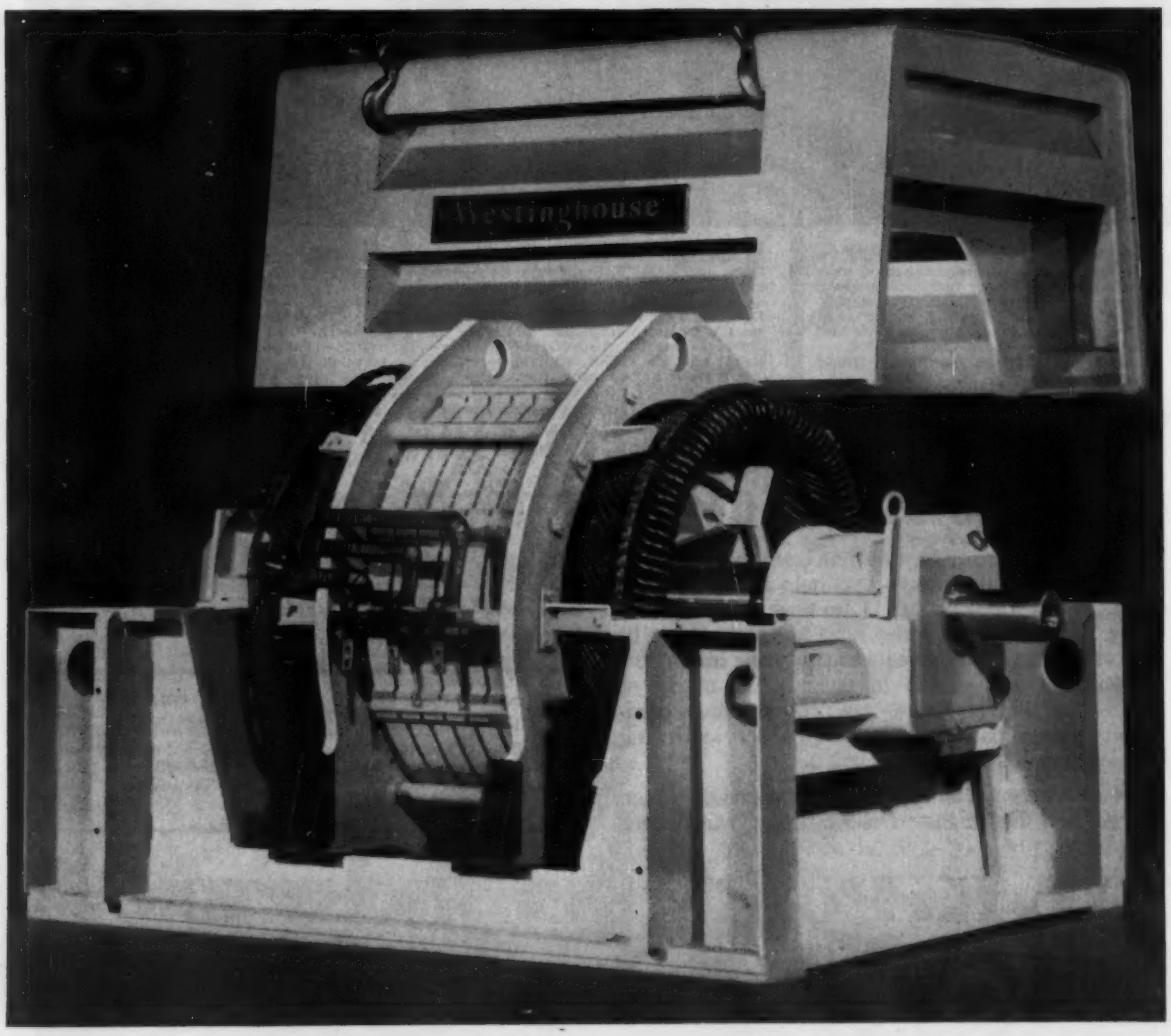
Testing of Delta-Star Transformers begins with materials. Destructive and operative tests are carried out regularly on insulations, oil, core steel, wire—every part of every unit. The superior quality of Delta-Star Transformers *rests on tests.*

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Connors Steel, Delta-Star Electric, Disston, Forge & Fittings, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan-Kidd Steel, H. K. Porter Company (Canada) Ltd.

Revolutionary new Westinghouse F/A Motor gives you five major advantages



First fully accessible motor ... takes guesswork out of inspection

For the first time in large motor history, the motor housing is completely separate from the stator, with all the benefits such construction implies.

Inspection — once a matter of partial visibility and guesswork — is now a thorough and easy operation which insures your motor investment. Advantages impossible in conventional motors are standard features of this F/A Motor design.

1. Full accessibility. Total inspection is possible for the first time. Enclosures are quickly removed, easily replaced. Reassembly is automatically precise.
2. Inherently quiet. Housing is isolated from the stator, reducing transmission of vibration and noise.
3. Thermalastic® insulation. Recognized as the finest available, it assures long life and protection of coils.
4. The same basic components — rotor, stator, bearings — which have made Westinghouse motors famous for long, efficient service life.
5. Easy to connect. No conduit box. Cables pass through the base bottom with extra-ample room to connect motor leads.

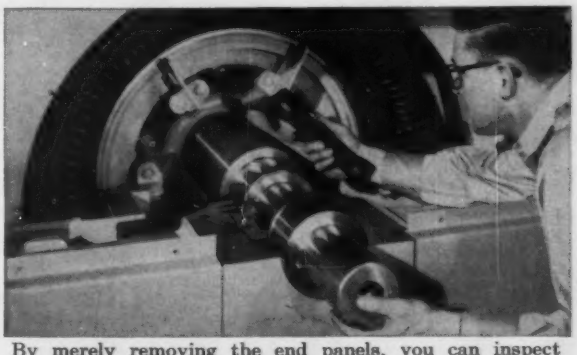
These and many other qualities make the new Westinghouse F/A Motor your best investment. It is presently available in large induction motors, both squirrel-cage and wound rotor. Various types of enclosures include dripproof, splashproof, weather protected, force ventilated, enclosed self-ventilated with cooler and TEFC tube type. Horsepower ratings range from 250 up to 7000, depending on speed.

For full information, call your Westinghouse representative, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

J-15011

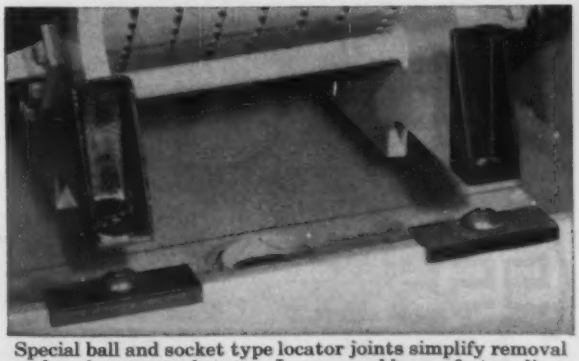
YOU CAN BE SURE...IF IT'S **Westinghouse**

Protruding conduit boxes are gone. Cable comes up through the base, leaving plenty of room for connecting motor leads.

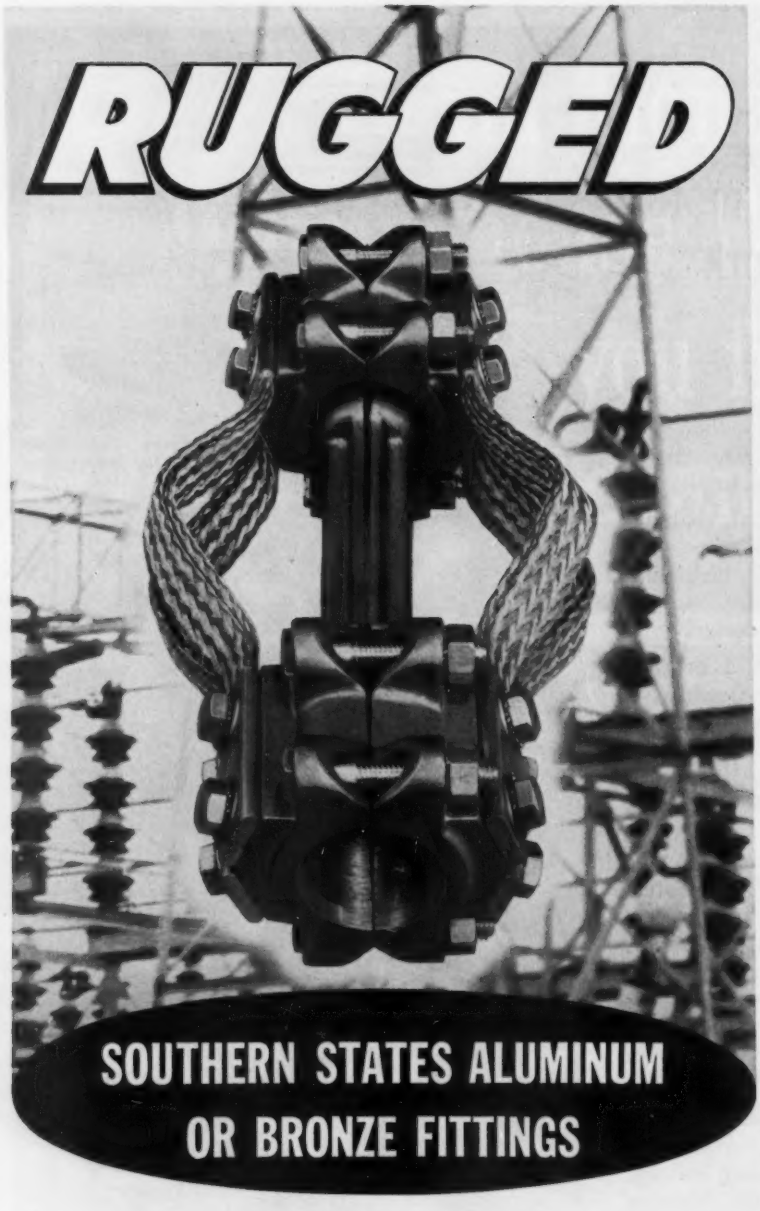


By merely removing the end panels, you can inspect windings and bearings.

Remove bearing cap, top bearing shell and oil ring; then the bottom bearing shell rolls out for easy inspection.



Special ball and socket type locator joints simplify removal and replacement of stator. In reassembly, perfect realignment is automatic.



Extra ruggedness at critical stress points receives special attention in the design of Southern States connectors. Ears and walls are husky enough to take the full squeeze of clamping bolts without visible distortion. This extra ruggedness, without excessive bulkiness or weight, is made possible by careful engineering design — backed by more than 25 years experience in producing connectors. *Never underestimate the importance of a good connection!*

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

Compact fully magnetic **a-c crane control** system for light industrial jobs has small masters which can be mounted up front, controllers at the rear of cab, to provide operators with greater freedom of movement. Type VL also available for floor-operated cranes. Bulletin 6431.—Electric Controller & Mfg Co, 4500 Lee Rd, Cleveland 28, Ohio.

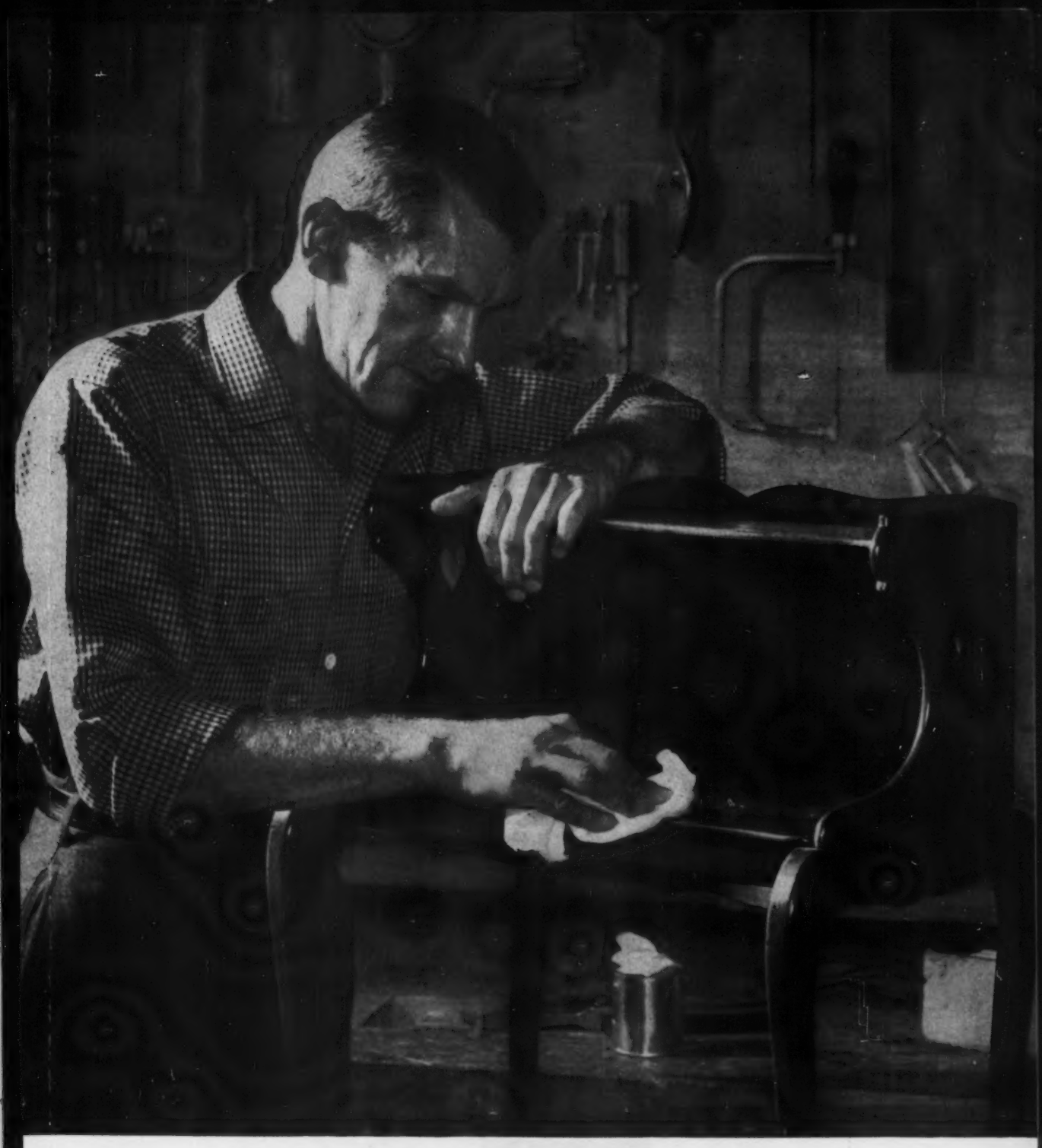
Magnetic core **logic breadboard** has 22 elements plus drivers on a printed-circuit panel for mounting in a standard 19-in. rack. All logical connections are brought out to plug-in terminals for patch-cord connection. — Mack Electronics, Dept D, 40 Leon St, Boston 15, Mass.

No. M-1148 50-kw **silicon rectifier power supply** for hoists and cranes has 230-v, 200-amp d-c output with overload rating of 400 amp for one minute; 250 amp for 30 min. Unit operates from a 460-v, 3-phase, 60 cps line and has 5% maximum regulation, 5% RMS ripple. Efficiency is 94% and power factor, 95%. —Perkin Engineering Corp, 345 Kansas St, El Segundo, Calif.

Six-passenger **truck cabs** are now available for selected medium and heavy duty trucks. The "Travel-Crew" cabs are designed for factory installation on A and AC-160 models (16-19,000 lb GVW), on A and AC-180 models (19-22,000 lb GVW) and four-wheel drive models in these two series.—International Harvester Co, 180 N Michigan Ave, Chicago 1, Ill.

Multi-purpose **transmission unit,** weighing 6½ lb, has 128 oz-in. output torque. It features a low inertia gear train and requires no lubrication. Instantaneous speed changing requires no gear change.—Hamilton Watch Co, Hathaway Instrument Div, 5800 E Jewell Ave, Denver 22, Colo.

Portable electric **cable splicing stand** can be set up or knocked down by one worker in less than 2 min. When disassembled, it forms a 16-lb package that fits in a small section of a utility truck. It is adaptable to use with all types of cable up to 3 in. in diameter.—Austin Powder Co, Cleveland 13, Ohio.



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full 600-amp subtransmission load

with S&C's Alduti Load Interrupter

Here are two important reasons for full-load, full-voltage switching (as distinguished from loop sectionalizing where the voltage across the switch is low):

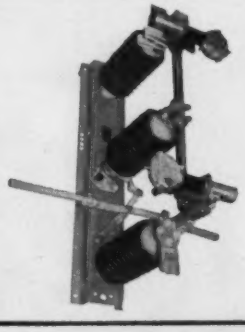
First—Emergency situations (wires down, etc.) demand quick action, hence dumping the load. There is no time to set up communications for complicated breaker and switch sequencing.

Second—There's always the possibility of an operator error or misunderstanding, with the result that a loaded circuit may be dumped inadvertently.

Under these circumstances, you will need *full* switching capability—with no limitation on the voltage across the device or on the load current.

The S & C Alduti Load Interrupter, with a record of 10 years of successful field operation, gives this kind of performance. It has had complete field tests under all circuit conditions, not simply line dropping or loop opening but at full load and at full voltage—600 amperes at 34.5 kv. Besides, this testing has been made extensive enough to provide published life ratings. And you get all this at the lowest price premium over bare disconnects.

Specify S & C Alduti Load Interrupters. For further information: S & C Electric Company, 4421 Ravenswood Ave., Chicago 40, Ill. In Canada: S & C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.



The S & C Alduti Load Interrupter (Double-Break style). Illustrated here is the 600-ampere 34.5 kv rating. Note the *two* interrupting units in series.

If you are considering switches at 23 kv and 34.5 kv, check this list to be sure you are getting:

1. Full 600-amp load switching capability without line breaker or feeder breaker openings. ☐
2. Positive interruption of even very heavy current in parallel or loop circuits. ☐
3. Sure interruption of associated magnetizing and charging currents—cable charging included. ☐
4. A fully tested interrupting device, tested not only for full ratings but also for operational life. ☐
5. Maximum attainable safety to equipment or personnel if device is inadvertently opened. ☐
6. A device which uses a maintenance-free interrupting medium. ☐
7. A device with contacts which can be left for long periods of time without maintenance. ☐
8. A device that can be mounted in any position; vertical, upright, or inverted. ☐
9. A device which has a long period of field use and operational success behind it. ☐
10. A device which operates without external arc. ☐

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MANUFACTURERS LITERATURE

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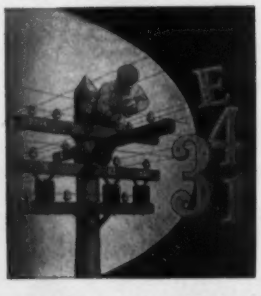

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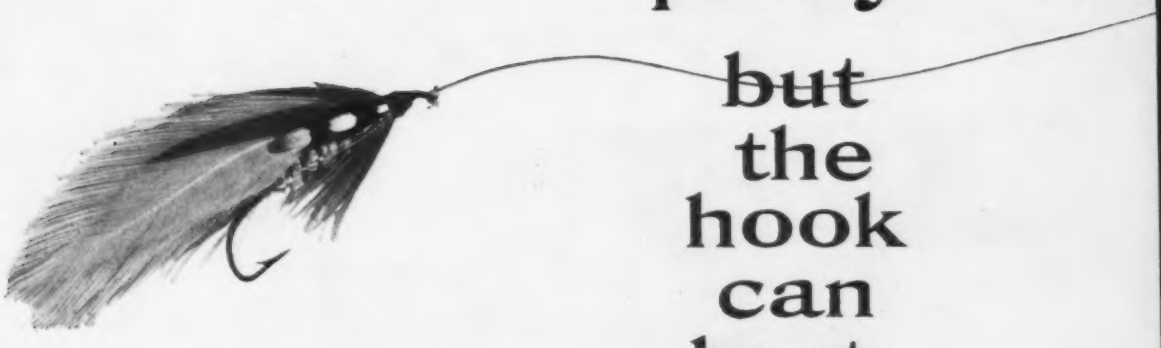
the feathers are mighty pretty



but the hook can hurt

The defenders of public power have done a first-rate job of making their lure enticing—but it's still a trap.

They began by giving their scheme an attractive name, suggesting a project owned by all the people and operated for the common good. "Private" power, conversely, seems to connote an enterprise conducted for private profit, and depriving the people of part of the benefit that should accrue to them.

From there on the public power advocates reason thus: The sources of power (such as fast-moving water) are natural resources belonging to everyone, and should not be allowed to fall into private hands.

There's the delusion. All industries use natural resources of one kind or another. But no resource has much value until it is extracted, cultivated, or otherwise made useful by human effort. This effort, which is "privately" exerted by individuals, is the real cost of the final product, and accounts for most of its price.

No matter who does the job of converting a raw resource to a useful commodity—government or private enterprise—the same essential costs must still be paid. The question therefore boils down to this: Under what type of organization—public ownership or private ownership—is power likely to be generated most economically, and paid for by those who should logically pay for it, the *users*?

Right there's the hook. Because under public ownership, some people get electricity at tax-free rates, while others pay taxes not only on the "private" power they use themselves but must ante up still *more* taxes to pay for the publicly owned power projects too.

Because America long ago chose private enterprise against "public" control of economic activity, its people today are rich and strong and free. If they mean to stay that way, they had better stop nibbling around the bright but deadly "public power" bait.*

* Based on material from The Guaranty Survey, published by Guaranty Trust Company of New York.

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Medallion Modernized Home Triples Load

The midwest's first home to receive a Live Better Electrically Medallion for modernization is that of Mr. & Mrs. Louis E. Porterfield, Crystal Lake, Ill.

Basis for the award by Commonwealth Edison Co is that the 43-yr-old home has been remodelled to meet the utilitiy's Bronze Medallion Modernized Home standards for appliances, Housepower, and lighting.

Electrical improvements include a 200-amp service entrance—double the minimum Medallion standard—12 general purpose lighting circuits, and special 240-v circuits for kitchen and laundry appliances.

Other improvements include a completely revamped kitchen to include two wall ovens and four-burner and two-burner surface cooking units (shown in photo), and an automatic washer and dryer, dishwasher, refrigerator and built-in mixer-blender. The former back porch has been turned into a family room with baseboard heating. New lighting fixtures, switches and controls were installed in the kitchens, family room, dining room, and other key locations.

Commonwealth Edison reports that following the modernization at the Porterfield home, kwhr usage almost tripled, with an increase from 380 to 1108 kwhr per month.

At an open house on November 1 and 2, sponsored by Commonwealth Edison and participating manufacturers, over 400 persons viewed the home. It is also featured in the November issue of *Parents'* Magazine.

Predictions are that more than 300,000 American homes will be modernized in 1959 to qualify for the Medallion.

IBE Women's Confab Scheduled for January

"Facing the Challenge of Change" will be the theme for the third annual Live Better Electrically Women's Conference to be held at Chicago's Edgewater Beach Hotel Jan. 8, 9, and 10, 1959.

The Conference will be sponsored again by the Home Service Committee of the Edison Electric Institute. Speakers will include Poppy Cannon, food editor, *House Beautiful;* Helen Walcott, director of home economics, McCann-Erickson; Mrs. Marguerite Fenner, home service director, Hawaiian Electric Co; and Jan Reynolds, residential lighting and color consultant, Sylvania Electric Products Co.

Advance registrations may be made by writing: Miss Anna Bines, home service director, Texas Electric Service Co, Ft. Worth 1, Tex.

HEATING & COOLING

Baseboard Heating System Developed by Hotpoint

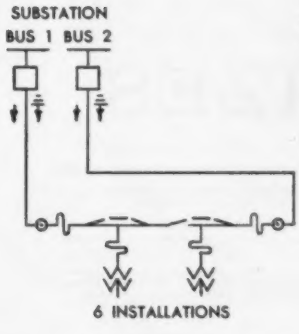
A low-density electric baseboard heating system for new homes, remodeling, or as auxiliary heating for bathrooms, porches or utility rooms, has been developed by Hotpoint Co, Chicago.

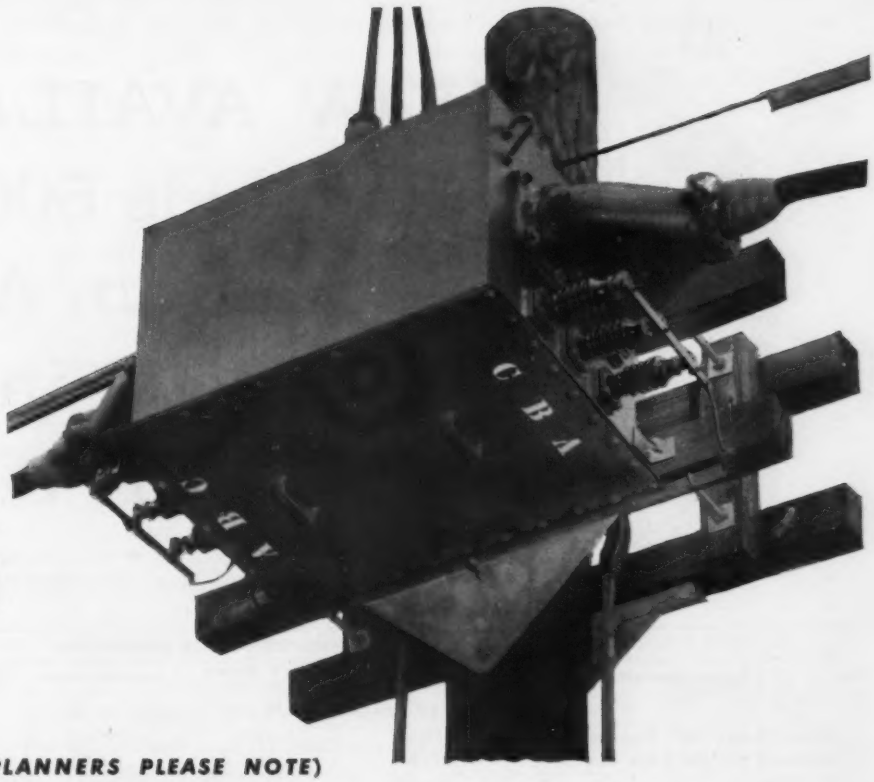
Designed around the "Calrod" heating unit, developed by Hotpoint, this unit is embedded in a specially designed convector. As cool air falls to the floor level, it is drawn off and heated as it passes over and around the convector. The modular system allows home owners to have a separate heating system in each room, thermostatically controlled individually.

Baseboard heating panels come in 4- and 6-ft lengths. They are 6-in. high and 2-in. deep and are installed around the perimeter of the room where heat is needed most, between the outdoor and the household.

Electric Heat Firm Formed

Ramco Manufacturing & Engineering Co has been formed in Portland, Ore. for the manufacture of residential and commercial electrical heating equipment, including baseboard, wall, and bathroom type units. The company, located at 5413 N.E. Columbia Blvd, will also manufacture other types of electric equipment.





(SHOPPING CENTER PLANNERS PLEASE NOTE)

A SWITCH YOU LOOK UP TO

The compact G&W, Type RA (full load break) 400 ampere, 15kv sectionalizing switch shown above is one of six that played an important part in an interesting departure from conventional designs to serve the electrical needs of a midwestern shopping center. Each switch is mounted on a pole opposite a transformer structure. Aerial cable laterals from the transformer primaries terminate at the top of the switch. The dual-fed 12,000 volt primary line enters on one side and leaves on the other side of the switch.

Two rod-connected operating levers on each switch can be locked in one of four positions: test ground, on, off and transformer by-pass. Normally, the line is "open" (one lever is in the "on" and one is in the "off" position) at one of the sectionalizing switches and three transformers are fed from each circuit. A number of combinations make it possible to isolate a section of the primary line or a transformer without interrupting customer service.

Details of this shopping center installation are available by writing to G&W.

VOLTAGE CHARACTERISTICS

voltage rating	60 cycle withstand dry	impulse withstand 1½ x 40 wave
7.5kv	36kv	95kv
15.0kv	50kv	110kv
23.0kv	70kv	150kv
34.5kv	95kv	200kv

CURRENT CHARACTERISTICS

ampere rating	switch	amperes	
		momentary	4 seconds
400	standard	20,000	15,000
	special*	30,000	19,000
1000	standard	40,000	35,000
	special*	50,000	40,000

*silver inlaid contacts

The RA oil switch is unrivalled. Its flexibility puts it in a class of its own. Add to this the quality of materials and craftsmanship that go into it and you have a switch you look up to.

A design of the simplest type of oil switch to one having an unusual degree of flexibility can be adapted to your needs. Consult a G&W representative to help you decide which will best suit your plans.

G&W ELECTRIC SPECIALTY COMPANY
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D582

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Reynolds 5005* Aluminum Alloy Conductor in LARGER SIZES

*5005 is a new high strength all-aluminum alloy conductor developed by Reynolds. Write for brochure.

PHYSICAL CHARACTERISTICS OF BARE CONDUCTORS

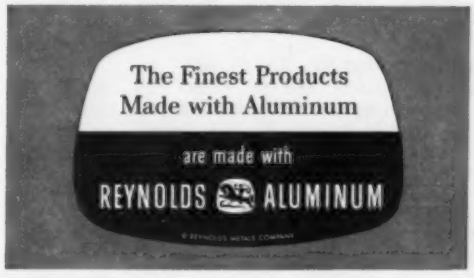
Type of Conductor	Size of Conductor (CM)	Size of Strands, Inches	Cable Dia., Inches	Weight per 1000 ft., Lbs.	Ultimate Strength, Lbs.
336,400 CM—26/7 and 18/1 ACSR Diameter Equivalents					
5005—19 Str. (18/1 Dia. Equiv.)	355,040	.1367	.6835	333	8,911
5005—37 Str. (26/7 Dia. Equiv.)	392,466	.1030	.7210	369	9,989
EC—19 Str.	336,400	.1331	.6660	316	5,940
EC—37 Str.	336,400	.0954	.6678	316	6,420
18/1 ACSR	336,400	.1367	.6835	365	8,625
26/7 ACSR	336,400	(.1138 Al.) (.0885 St.)	.7210	463	14,050
477,000 CM—26/7 and 18/1 ACSR Diameter Equivalents					
5005—19 Str. (18/1 Dia. Equiv.)	503,340	.1628	.8140	473	11,388
5005—37 Str. (26/7 Dia. Equiv.)	556,050	.1226	.8582	522	13,955
EC—19 Str.	477,000	.1585	.7930	448.1	8,090
EC—37 Str.	477,000	.1135	.7950	448.1	8,600
18/1 ACSR	477,000	.1628	.8140	518	11,870
26/7 ACSR	477,000	(.1355 Al.) (.1054 St.)	.8580	657	19,430
636,000 CM—26/7 ACSR Diameter Equivalent					
5005—37 Str. (26/7 Dia. Equiv.)	739,610	.1414	.9898	694	18,041
EC—37 Str.	636,000	.1311	.9180	597	11,240
26/7 ACSR	636,000	(.1564 Al.) (.1216 St.)	.9900	875	25,000

ELECTRICAL CHARACTERISTICS OF BARE CONDUCTORS

Type of Conductor	Size of Conductor	Conductor Diameter, Inches	Resistance, Ohms per 1000 Feet	
			d.c. at 20°C.	60 Cycles at 20°C.
336,400 CM—26/7 and 18/1 ACSR Diameter Equivalents				
5005—19 Str. (18/1 Dia. Equiv.)	355,040	.6835	.0571	.0573
5005—37 Str. (26/7 Dia. Equiv.)	392,466	.7210	.0517	.0519
EC—19 Str.	336,400	.6660	.0516	.0518
EC—37 Str.	336,400	.6678	.0516	.0518
18/1 ACSR	336,400	.6835	.0516	.0518
26/7 ACSR	336,400	.7210	.0516	.0518
477,000 CM—26/7 and 18/1 ACSR Diameter Equivalents				
5005—19 Str. (18/1 Dia. Equiv.)	503,340	.8140	.0403	.0406
5005—37 Str. (26/7 Dia. Equiv.)	556,050	.8582	.0365	.0368
EC—19 Str.	477,000	.7930	.0364	.0367
EC—37 Str.	477,000	.7950	.0364	.0367
18/1 ACSR	477,000	.8140	.0364	.0364
26/7 ACSR	477,000	.8580	.0365	.0365
636,000 CM—26/7 ACSR Diameter Equivalent				
5005—37 Str. (26/7 Dia. Equiv.)	739,610	.9898	.0274	.0278
EC—37 Str.	636,000	.9180	.0273	.0277
26/7 ACSR	636,000	.9900	.0274	.0274

HIGH STRENGTH, LOW COST Reynolds 5005 Aluminum Alloy Conductor is now available in cable sizes larger than 7-strand. *These new cables are designed to permit use of standard accessories.* This eliminates complications associated with accessories required for non-standard sizes. The outside diameters are the same as the outside diameters of conventional ACSR in the 26/7 and 18/1 strandings. The electrical resistance characteristics are approximately the same as those of comparable ACSR and all-EC cables. These larger cables also feature sag characteristics that are a substantial improvement over the all-EC cables and that compare most favorably with those of 18/1 ACSR.

Check these characteristics for yourself in the tables shown on these pages – three typical cable sizes are covered as examples. Chart on catalog availability also shows complete line of larger sizes available. Investigate, too, the cost and labor saving potentials of these new larger sizes of Reynolds 5005 Aluminum Alloy Conductor. Complete data on the physical and electrical characteristics, and sag and tension properties is available now. Contact your local Reynolds branch office, your Reynolds Electrical Distributor or write *Reynolds Metals Company, P. O. Box 2346EL, Richmond 18, Va.*



Watch Reynolds new TV shows—"WALT DISNEY PRESENTS" and "ALL-STAR GOLF"—every week on ABC-TV.

COMPARISON OF SAGS OF BARE CONDUCTORS AT 60°F, FINAL MAXIMUM DESIGN TENSION 30% OF ULTIMATE STRENGTH

Type of Conductor	Size of Conductor, CM	Sags (Ft.) for Various Span Lengths											
		Heavy Loading				Medium Loading				Light Loading			
		300	400	500	600	300	400	500	600	300	400	500	600
336,400 CM—26/7 and 18/1 ACSR Diameter Equivalents													
5005—19 Str. (18/1 Equiv.)	355,040	3.6	5.5	8.3	13.0	3.0	4.7	6.9	9.4	2.5	4.1	6.0	8.4
5005—37 Str. (26/7 Equiv.)	392,465	3.5	5.5	7.7	11.7	2.9	4.7	6.8	9.4	2.4	4.0	6.1	8.4
EC—19 Str.	336,400	4.4	9.3	15.1	21.8	4.1	6.4	9.1	13.1	3.4	5.6	8.2	11.3
18/1 ACSR	336,400	3.6	5.7	9.7	13.5	3.1	5.0	7.3	9.9	2.6	4.3	6.5	8.9
26/7 ACSR	336,400	2.7	4.2	6.3	8.5	2.3	3.9	5.8	7.9	1.9	3.3	5.1	7.1
477,000 CM—26/7 and 18/1 ACSR Diameter Equivalents													
5005—19 Str. (18/1 Equiv.)	503,340	3.9	6.0	8.4	12.1	3.3	5.2	7.6	10.2	2.8	4.5	6.7	9.2
5005—37 Str. (26/7 Equiv.)	556,050	3.5	5.5	7.8	10.4	3.0	4.8	6.9	9.4	2.5	4.0	6.0	8.4
EC—19 Str.	477,000	4.7	7.8	12.1	18.5	4.2	6.5	9.3	12.6	3.5	5.8	8.4	11.6
18/1 ACSR	477,000	3.8	5.8	8.2	11.3	3.2	5.1	7.4	10.0	3.1	5.1	7.4	10.0
26/7 ACSR	477,000	2.7	4.5	6.5	8.8	2.3	4.0	5.9	8.0	1.8	3.5	5.2	7.2
636,000 CM—26/7 ACSR Diameter Equivalent													
5005—37 Str. (26/7 Equiv.)	739,610	3.7	5.6	8.0	10.6	3.1	4.9	7.1	9.7	2.5	4.2	6.3	8.7
EC—37 Str.	636,000	4.6	7.0	10.1	14.8	4.0	6.3	9.1	12.3	3.4	5.6	8.2	11.3
26/7 ACSR	636,000	2.8	4.6	6.7	9.0	2.4	4.0	6.0	8.3	2.1	3.5	5.5	7.5

5005 MULTILAYER CONDUCTORS AVAILABILITY LISTINGS

Code Word	Area of Cross Section		ACSR Physical Dia. Size, CM	Number and Diameter of Strands	Cable Dia., Inches	Ultimate Strength, Lbs.	Wt. per 1000 Ft. Lbs.	Standard Reels			
	CM	In.²						Length each Piece, Feet	Number Pieces on Reel	Reel Size	Pounds on Reel
Ratch-Bare	281,460	.2211	266,800—18/1	19 x .1217	.6085	7,064	264	6,894	1	48A	1820
Radar-Bare	355,040	.2789	336,400—18/1	19 x .1367	.6835	8,911	333	11,306	1	63A	3765
Rede-Bare	419,450	.3295	397,500—18/1	19 x .1486	.7430	10,231	394	9,556	1	63A	3765
Rex-Bare	503,340	.3954	477,000—18/1	19 x .1628	.8140	11,388	473	7,960	1	63A	3765
Ruble-Bare	587,360	.4614	556,500—18/1	19 x .1758	.8790	13,289	552	6,821	1	63A	3765
Sabot-Bare	311,120	.2444	266,800—26/7	37 x .0917	.6419	8,029	292	15,171	1	63A	4430
Scud-Bare	392,470	.3083	336,400—26/7	37 x .1030	.7210	9,989	369	10,352	1	63A	3820
Sepal-Bare	463,245	.3639	397,500—26/7	37 x .1119	.7833	11,626	435	8,782	1	63A	3820
Sine-Bare	556,050	.4368	477,000—26/7	37 x .1226	.8582	13,955	522	6,743	1	63A	3520
Stet-Bare	648,470	.5094	556,500—26/7	37 x .1324	.9268	16,276	609	6,182	1	63A	3765
Spar-Bare	739,610	.5810	636,000—26/7	37 x .1414	.9898	18,041	694	5,504	1	63A	3820
Solar-Bare	927,000	.7282	795,000—26/7	37 x .1583	1.1081	22,283	870	4,046	1	63A	3520

Note: Sizes and strandings other than those listed are available on special inquiry.

Manufacturers Literature

To request literature use Reader Service form on page 120

GENERATION

• **DUAL-MODE EXCITATION SYSTEM,** "Magaset" for ac generator control, new alternator control fully described in Bulletin 8.010. Electric Regulator Corp, Pearl St., Norwalk, Conn. A1

• **HIGH-PRESSURE CLOSURES** for feedwater heaters, and for other high pressure and high temperature exchangers are detailed in Bulletin 201.1K1. American-Standard. Ross Heat Exchanger Div, Buffalo 5, N. Y. A2

• **FEEDWATER HEATER STANDARDS,** 2nd edition provides new material relating to design, construction and installation. 22 pages. Price: $2. Feedwater Heater Mfr Assoc, Inc, 53 Park Place, New York 7, N. Y. A3

• **METAL FRAMING SYSTEM,** all-purpose, bolted. Pub. No. 810, pocket-sized version; No. 5, 180-page reference. Unistrut Products Co, 933 W. Washington Blvd, Chicago 7, Ill. A4

TRANSMISSION

• **R.E.M. BULLETINS:** Royal Electric Mfg Co, Inc, 1122 E. 87 St., Chicago 19, Ill.

Standardized Substations . . . or "package" substations, in steel or aluminum. Materials listed and drawings provided for both multiple incoming line and single incoming line substations. 8 pages. Bul. 21-A. A5

Air Break Switch, Type RVL, vertical type available in ratings from 7.5 kv-161 kv, 400/600, and 1200 amp. Can be mounted in horizontal, vertical, or underhung position. Bulletin No. 20-A. 12 pages. A6

• **PREVENTIVE MAINTENANCE** . . . of Power Transformers Through Modernization. Includes component replacement descriptions, component adaptations, methods of oil preservation. 8 pages. Booklet B-7299. Westinghouse Electric Corp, P.O. Box 2099, Pittsburgh 30, Pa. A7

DISTRIBUTION

• **POTHEADS,** Capnut Style. Ordering and application information in 36-page Cat. AB. G&W Electric Specialty Co, 3500 W. 127 St., Blue Island, Ill. A8

• **AIR-BREAK CONTACTOR** (Type 256A) for high-voltage switching for applications up to 5 kv. Table of ratings and dimensions included. 6-page folder, 14B7303B. Allis-Chalmers, Milwaukee 1, Wis. A9

• **TERMINAL CONNECTORS,** with tabbed thumb index. Special design section devoted to non-standard connectors, to be made up from standard component parts. Catalog 57, post-type binder for adding new and revised pages. Anderson Electric Corp, P.O. Drawer 2151, Birmingham 1, Ala. A10

• **UNDERGROUND CONNECTORS** . . . "MAC Connectors—Cable Joints." Specify Catalog No. 3. Applies to 120/208-v and 265/460 v ac circuits. D. S. MacCorkle, Inc, One Newark St., Hoboken, N. J. A11

• **GE PUBLICATIONS:** General Electric Co, Schenectady 5, N. Y.

Oil or Pyranol-Filled distribution transformers. Bulletin GEA-6832. 4 pages, describes two GE transformers of this type, rated 112½ to 500 kva. A12

Sealed Dry-Type Transformers, nitrogen-filled. Bulletin GEA-6790, 8 pages, gives key standard and optional features of aluminum-wound sealed dry-type transformers rated 300 kva and above. Design variations illustrated. A13

Power Capacitors . . . 50 and 25 kvar for high-voltage applications described in Bulletin GEA-6662A, 8 pages. A14

• **DISTRIBUTION TRANSFORMERS,** single-phase, oil-filled. Type WA, 3 to 167 kva, and Type SWA, 10 to 167 kva, described in Bulletin S-401-C. Formulae for calculating annual operating costs. The Standard Transformer Co, Dana Ave., Warren, O. A15

• **FLEXIBLE CORDS & PORTABLE CABLES** . . . technical information combined with catalog data in Bulletin 1108, 64 pages. Okonite's line of mold-cured Okoprene (neoprene) sheathed cords and cables. Okonite Co, Passaic, N. J. A16

• **CABLE TRAYS, SUPPORT SYSTEMS** for all types of cables, wiring, tubing described in Catalog 858, 78 pages. P-W Industries, Inc, Duncan & Melrose Sts., Philadelphia 24, Pa. A17

• **METALLIC TUBING** . . . Color-coded, lightweight raceways for protecting electrical wiring systems. 12 pages. Bulletin RCP-900. Rome Cable Corp, Rome, N. Y. A18

• **INSULATED LIFT** . . . with Spiralloy outer boom, and basket for overhead maintenance and construction. 4 pages. Asplundh Chipper Co, 501 York Rd., Jenkintown, Pa. A19

LIGHTING

• **LUMINOUS CEILING SYSTEMS.** Pamphlet, 8 pages, with illustrations and specifications. Also, luminous ceiling lighting equipment. Luminous Ceilings Inc, 2500 W. North Ave., Chicago 47, Ill. A20

• **INCANDESCENT LUMINAIRES.** Catalog SL1-1, 20 pages, provides detail on Line 3 luminaires. Complements bulletin SL1, which also contains photometric and application data. Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis. A21

METERS AND INSTRUMENTS

• **CLAMP-TYPE AMMETERS** . . . "Tong Test", ac, dc. Tests for low-current readings outlined. 8-page brochure. Columbia Electric Mfg Co, 4519 Hamilton Ave., Cleveland 14, O. A22

• **GE PUBLICATIONS:** General Electric Co, Schenectady 5, N. Y.

Recording Volt-Ammeter, hook-on, Type CF-7, and inkless recorder, Type CF. Bulletin GEA-6821 covers portable and switchboard models. 16 pages. A23

Recorders, Strip-Chart and Recording Controllers, Type HG single-point and Type HG multi-point. Bulletin GEA-6792, 12 pages. A24

INDUSTRIAL

• **SYNCHRONOUS MOTORS & CONTROLS.** 27-page booklet, illustrated, gives motor selector charts, application data, formulae for calculating power factor. Booklet B-7292. Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa. A25

• **CONTROL CENTERS** . . . Specifications of new standards for heavy duty control center construction, outlined in 4-page Bulletin 2-2000A. Federal Pacific Electric Co, 50 Paris St., Newark 1, N. J. A26

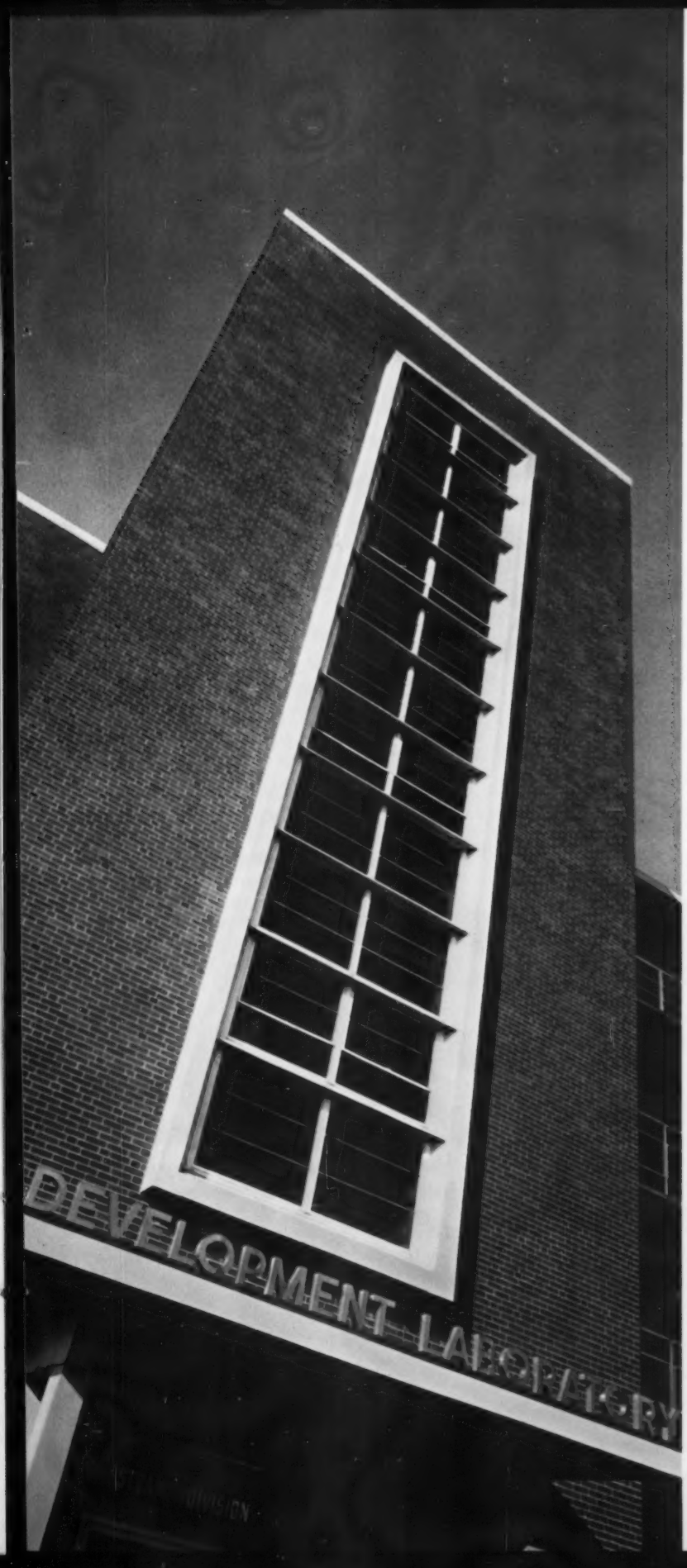
• **WEATHER-PROTECTED MOTORS,** rated from 250 to 2000 hp, for outdoor operation under extreme weather conditions, described in 6-page bulletin No. 2550. Louis Allis Co, 427 E. Stewart St, Milwaukee 1, Wis. A27

MATERIALS

• **INSULATION SYSTEM.** Bulletin 05B8341A describes impervious insulation system for motor and generator stator coils. Allis-Chalmers Mfg Co, Milwaukee 1, Wis. A28

• **ELECTRICAL INSULATING TAPES.** Folder has charts for friction tapes, splicing compounds, and plastic tapes. Six-pages. Plymouth Rubber Co, Inc, Canton, Mass. A29

• **FLEXIBLE COATED INSULATION,** "Fibremat". 4-page Bulletin IRV-B-4. Dept. D8-342, Irvington Division, Minnesota Mining and Mfg Co, 900 Bush St., St. Paul 6, Minn. A30



The credit goes to utility men

Of the many who share credit for today's low-cost electricity, one group deserves special mention. They are the utility men whose suggestions initiate many Westinghouse research and development projects . . . projects that result in new and more efficient designs for machines and equipment used by utilities.

Utility men have strong partners in the more than 6,000 scientists, engineers and technicians who work in the many Westinghouse research and development laboratories. For example, in this $6,000,000 Steam Development Laboratory, more than 100 engineers and technicians are developing new metals and more efficient designs for turbines and allied equipment.

Plowback of earnings into research at Westinghouse produces the *advanced* design machines that help utility men in their battle to generate more and more electricity, always at low cost.

YOU CAN BE **SURE**...IF IT'S

Westinghouse

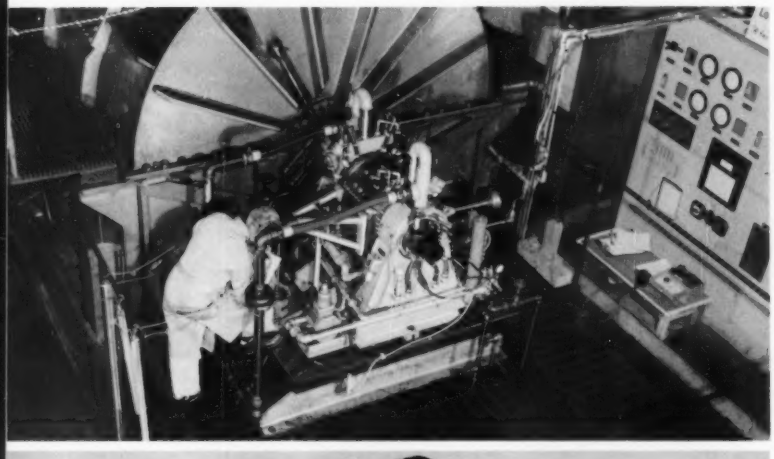
The 1970 turbine is here . . . in the Westinghouse laboratory!

ANOTHER EXAMPLE OF EARNINGS PLOWED BACK

It's here today because every day Westinghouse research and development engineers are getting the answers to the long-range questions, such as . . .

"Will the rotor alloy now used do the job under projected steam conditions?" If not, a research project is on its way to create the alloy that will be needed for the turbine of the future.

It takes longer to do the impossible, but Westinghouse starts doing it *before the need is an emergency.*



EFFICIENCY GAINS FOR L-P TURBINES

In the Steam Development Laboratory, a major development project is aimed at significant gains in the low-pressure end of the turbine. The project revolves around a unique L-P turbine test facility. Using this $1,000,000 development tool, Westinghouse engineers are testing numerous combinations of new designs, recording the performance of every part under varying conditions.

NEW BLADING ALLOY

What's to be used when advanced steam conditions exceed the limits of blading metals now available? Development engineers are now evaluating a new Westinghouse alloy that may be the metal of the future. *For example, at 1200°F,* the tensile strength is phenomenal—100,000 psi; the damping characteristics—excellent. After exhaustive tests are completed, Nivco alloy will be introduced as another Westinghouse "first."

WORLD'S MOST EFFICIENT TURBINE

A new peak of efficiency for that 1970 turbine will be assured by hard-won development steps taken within the next 12 years. A giant step is the turbine-generator now under construction for the Philadelphia Electric Company. *It will be the world's most efficient turbine.* This 325,000-kw super-critical unit will use the highest temperature and pressure steam ever projected . . . 5,000 psi at 1200°F.

JI-97233-2

YOU CAN BE SURE... IF IT'S Westinghouse

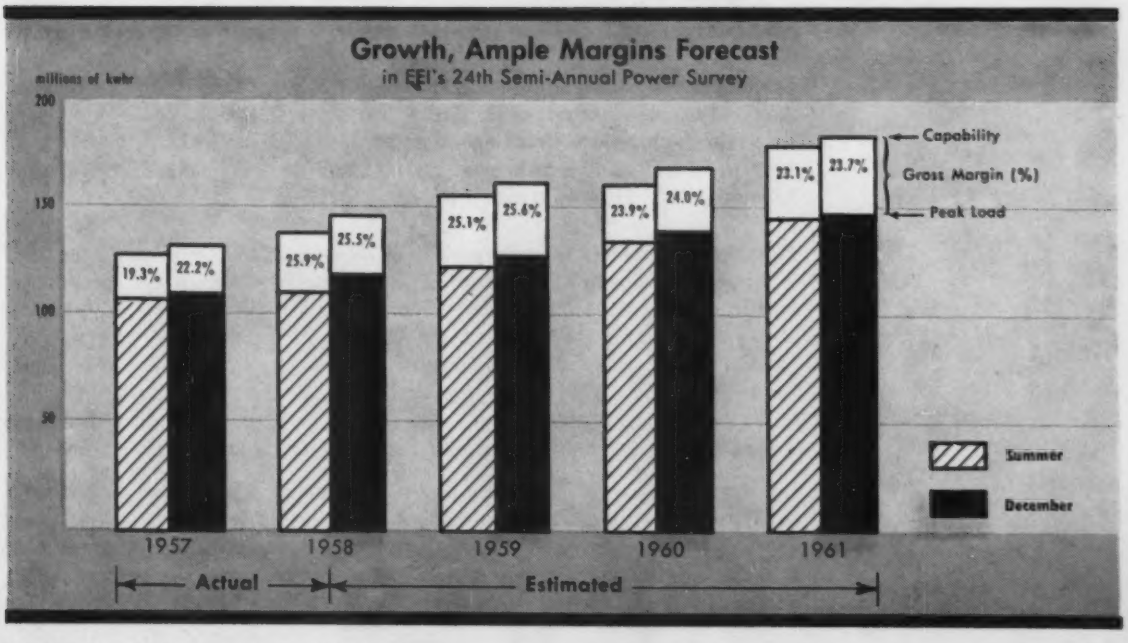
Peak Estimates Cut, but Still Up

Report on
EEI
Power Survey

Continued rapid growth of summer and winter peaks, with ample gross margins of capability to meet them: In a nutshell, that's Edison Electric Institute's view of the U. S. power picture through 1961 based on results of its 24th Semi-Annual Electric Power Survey taken last month. All estimates of peak loads and most estimates of capability have been shaved since the 23rd Power Survey was taken this past spring, but the latest survey still indicates that both December peaks and capability will keep rising through 1961 at a compounded annual rate of between 7% and 8%. Here are some other highlights from the survey (all data is based on mean hydro conditions):

- **December peak this year will hit 116,080,000 kw,** according to EEI's data. This would be an 8.6% rise from the '57 peak of 106,917,000 kw.
- **The 1958 summer peak rose to 109,171,000 kw**—exceeding 1957's summer peak of 106,740,000 kw by 2.3%.
- **Gross margin this December will reach 25.5%,** vs. 22.2% a year ago.
- **1958's growth in U. S. energy output is estimated at only 3.1%**—to a total of 646,299 million kwhr. But EEI expects a 10.9% rise in 1959 (to 717,007 million kwhr) followed by further rises of 8.6% and 7.6% in the years 1960 and 1961 respectively. By 1961, output is placed at 837,588 million kwhr.

The national trend toward summer peaks struck a snag this year, with only one of the eight areas in the Federal Power Commission's regional breakdown expected to end up with a summer peak. In 1957, four regions peaked in summer. In 1958, however, only the South Central region is expected to repeat. In the North Central and Southwest regions the normal trend of summer peaks is



Summer Peak Loads (Thousands of Kw)

expressed as % of following December peak

	1958		1959		1960		1961	
Region	Summer Peak	% of Dec '58	Summer Peak	% of Dec '59	Summer Peak	% of Dec '60	Summer Peak	% of Dec '61
1	22,558	90	25,475	94	27,406	95	29,226	95
2	19,502	90	21,776	92	23,530	93	24,953	93
3	20,546	90	23,041	91	25,105	92	27,203	92
4	13,465	99	14,626	100	15,717	101	16,850	102
5	12,562	127	14,421	130	16,157	132	17,819	133
6	2,289	94	2,628	99	2,873	99	3,110	100
7	7,372	77	9,093	87	9,529	83	10,381	86
8	10,877	100	11,907	102	12,826	103	13,709	102
Total U.S.	109,171	94	122,967	97	133,143	98	143,251	98

Values for total U.S. are sum of regional totals and do not reflect the fact that maximum loads occur in December for most regions.

due to be resumed in 1959. The West Central region's peak is expected in December from this year through 1961, although the summer peak in that region will almost equal the December peak in '61.

The survey found no evidence of any dramatic switch to summer peaks occurring prior to 1961, neither on a national scale nor regionally. But summer peaks are trending upward somewhat faster. By 1961, the survey estimates that the nation's summer peak will have risen by 31% to 143,251,000 kw, while the December peak will have increased 25% above its expected 1958 value to 145,664,000 kw. No new regions will swing to summer peaks by '61, according to the survey.

Leading region in output growth is the South Central, where EEI predicts better than a 40% increase by 1961. For 1959, however, the Pacific Northwest is slated for the biggest output gain—a 15.2% jump from 53,158 million kwhr in 1958 to 61,215 million kwhr next year. Output for that region in '58 will fall below the 1957 level by 0.6%, EEI estimates.

Most dramatic feature of a comparison of the 24th Power Survey with the 23rd is that every estimate of peak load has been revised downward in the past six months. Estimates of annual energy output have also been revised downward in all regions except the West Central, and so have most estimates of capability. However, the sharpest of the revisions are for the year 1958 only, and estimates for the next three years point to a gradual recovery of lost ground. For the entire U. S., the estimate of this December's peak has been cut 2.8% since the spring survey, with biggest slices coming off the East Central and Northwest regions.

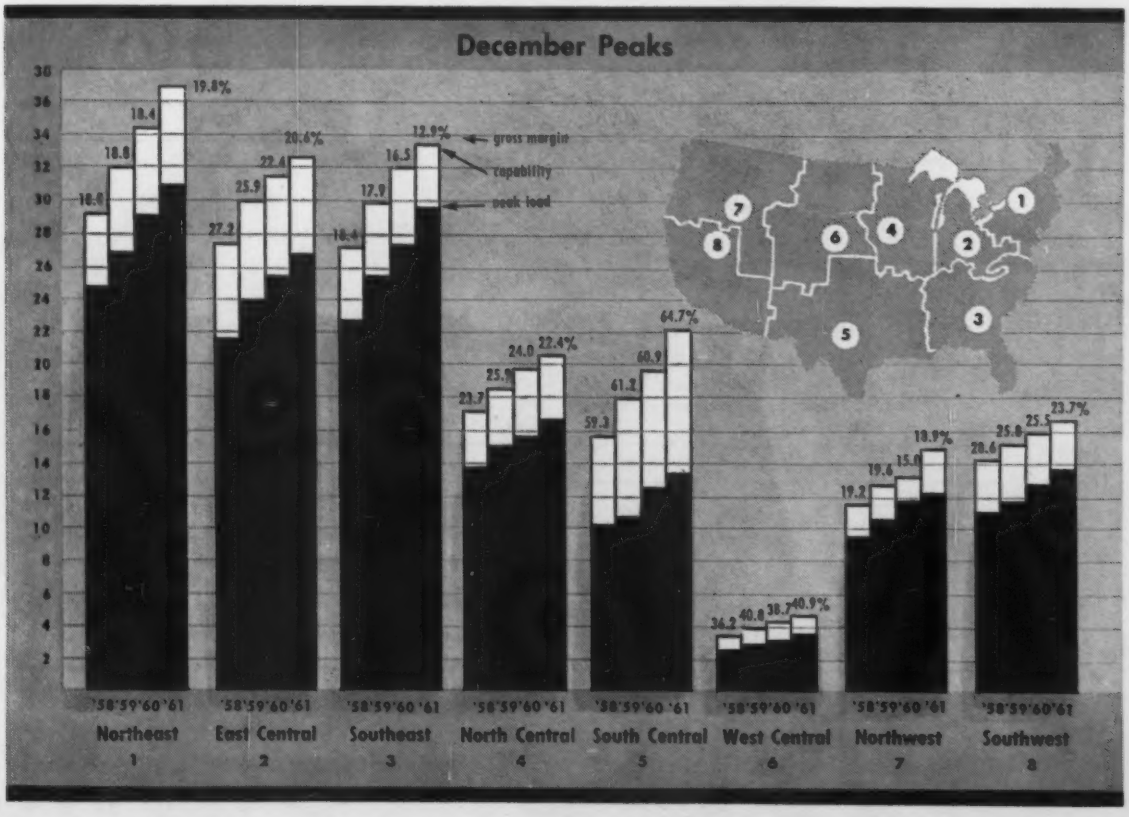
Estimated 1958 output for the Northwest has been revised downward by 10.4%, but only a 0.7% reduction was made in the estimate for that region in 1961. Similarly, 1958 output in the East Central region now looks 5.5% lower than it did in the spring, but the estimate of '59 output there was cut by only 3.3%, and the 1960 and 1961 revisions were minus 1.0% and 0.9% respectively. In

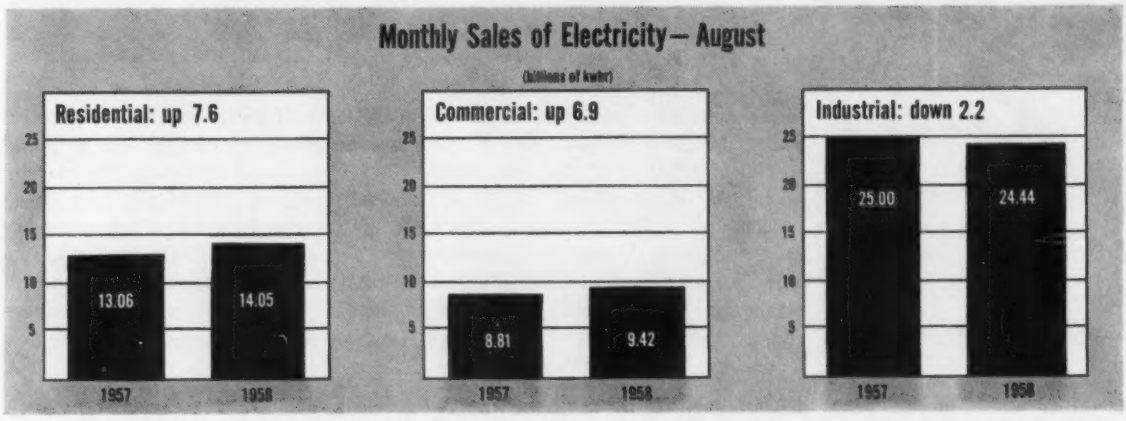
the West Central region, output for 1959, 1960, and 1961 were actually revised upward (by a little less than 1%), after a 0.5% reduction in the '58 estimate.

Gross margins are up this year, but will be whittled down over the next three years, according to the survey. Capability is scheduled to take an 11.5% jump to 145,656,000 kw by this December, which will put the national gross margin at 25.5%, compared with 22.2% a year ago. It must be made clear that these percentages, while they do provide a basis for comparison, do not show an actual gross margin in the way that they would for a single system. This is because the values of peak load and capability for the total U. S. are the sum of the regional totals for December, and do not reflect the fact that maximum loads in some regions occur in summer. This unavoidably gives the "U. S. gross margin" figures a considerable upward bias.

EEI found that the national trend of gross margin would be downward after 1959. Next year, capability is scheduled to rise 9.1% to 158,970,000 kw by December, while the peak is moving up 9.0% to 126,523,000 kw. This will result in a 25.6% margin. Over the next two years, however, peaks will rise more rapidly than capability, and the margin for the U. S. as a whole will drop back to 24.0% in 1960 and 23.7% in 1961.

All regions have fairly comfortable gross margins for 1958 and 1959, according to the survey. Lowest margin figures for this December's peak are in the East and the Pacific Northwest. Capability in the Northeast region will exceed the expected peak load by 18%, and the Southeast region's gross margin is put at 18.4%. In the western division of the Northwest region, a 16.5% gross margin is predicted for this December. The Northeast and Northwest will improve their margins in '59, but in the Southeast the margin is expected to slip throughout the period of the survey—ending up in 1961 with a fairly tight 12.9%.





Power Statistics . . .

		Latest Month	Year Ago	Annual Change %
Capacity	Aug.	136.19	125.75	8.3
Peak—Class I Systems (million kw)	Dec.	107.1	102.4	4.6
Estimated Dec. '58 Peak	Aug.	117.7	122.8	−4.2
Production—billion kwhr	Aug.	56.65	55.45	2.2
Hydro		11.19	10.03	11.6
Fuel		45.46	45.42	0.1
Sales—billion kwhr	Aug.	50.85	49.80	2.1
Residential		14.05	13.06	7.6
Commercial		9.42	8.81	6.9
Industrial		24.44	25.00	−2.2
Other		2.94	2.93	0.3
Fuel Consumption	Aug.			
Coal—million tons		12.61	13.33	−5.4
Oil—million barrels		6.57	5.79	13.5
Gas—billion cu ft		159.43	160.96	−1.0
Net Income Class A & B Co's—$ million	Aug.	120.03	109.69	9.4
Residential Customers—millions	12 mos.	47.39	46.49	1.9
Revenue per kwhr	ended	2.53¢	2.57¢	−1.6
Avg kwhr per customer	Aug. 31	3,314	3,104	6.8
Avg annual bill		$83.84	$79.77	5.1

Business Statistics . . .

Indexes: 1947–49 = 100				
FRB Industrial Production	Sept.	140	146	−4.1
ENR Construction Cost	Nov.	162.3	154.6	5.0
BLS Cost-of-living	Sept.	123.7	121.1	2.1
New Orders for Machinery (1950 = 100)	Sept.	146	141	3.5
NEMA Sales				
Insulation materials	Sept.	124	135	−8.1
Electric appliances		112	97	15.5
Wholesale prices				
Motors and generators	Aug.	146.5	142.6	2.7
Transformers and regulators		148.7	150.6	−1.3
Switchgear and fuses		173.8	166.9	4.1
GNP—annual rate—$ billion	3rd Qtr	440.0	445.6	−1.3

Significant changes: Engineering News Record's index of construction costs dropped two-tenths of a point from October to November, registering its first decline in 13 months.

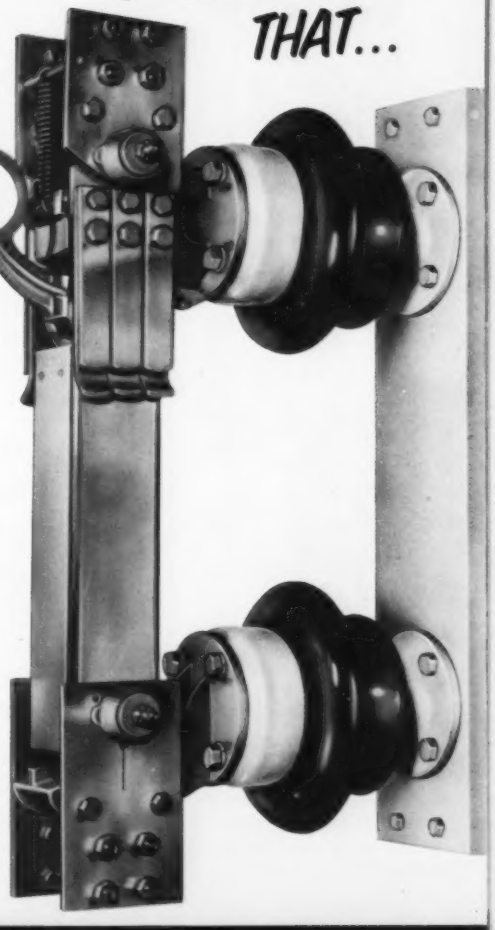
CHANCE BTH HIGH-CAPACITY DISCONNECTS

...NOW IN 3000 AMP RATING

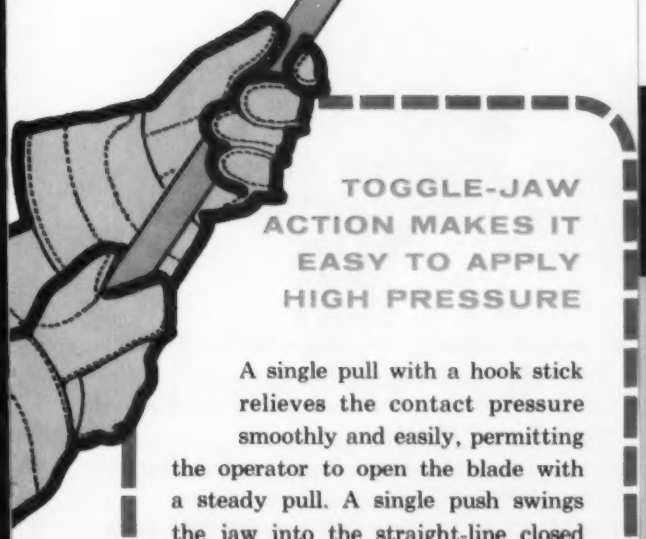
Here's an outstanding development in power switching equipment! The Chance Type BTH is a high-current disconnect that combines rugged construction with easy, positive operation. Now, the same operating and performance advantages of the 2000 Amp BTH are available in a 3000 Amp design.

The BTH meets all applicable AIEE and NEMA requirements. The 2000 Amp rating is available in voltage ratings from 7.5 to 46 KV; the 3000 Amp in ratings from 7.5 to 23 KV.

A NEW 3,000 AMP DISCONNECT THAT...



...OPENS WITH A SINGLE PULL!



TOGGLE-JAW ACTION MAKES IT EASY TO APPLY HIGH PRESSURE

A single pull with a hook stick relieves the contact pressure smoothly and easily, permitting the operator to open the blade with a steady pull. A single push swings the jaw into the straight-line closed position, gradually applying higher pressure to the blade as it closes.

This heavy duty disconnect gives new ease of operation in switching high-current circuits. High contact pressure is applied and relieved by the toggle-action of the jaw—minimizing operating effort.

This toggle-jaw action, plus the single blade operation, gives the operator positive control of the switch. In isolating, *one* pull disconnects the line completely—*one* closing and the switch is in *full* operating capacity.

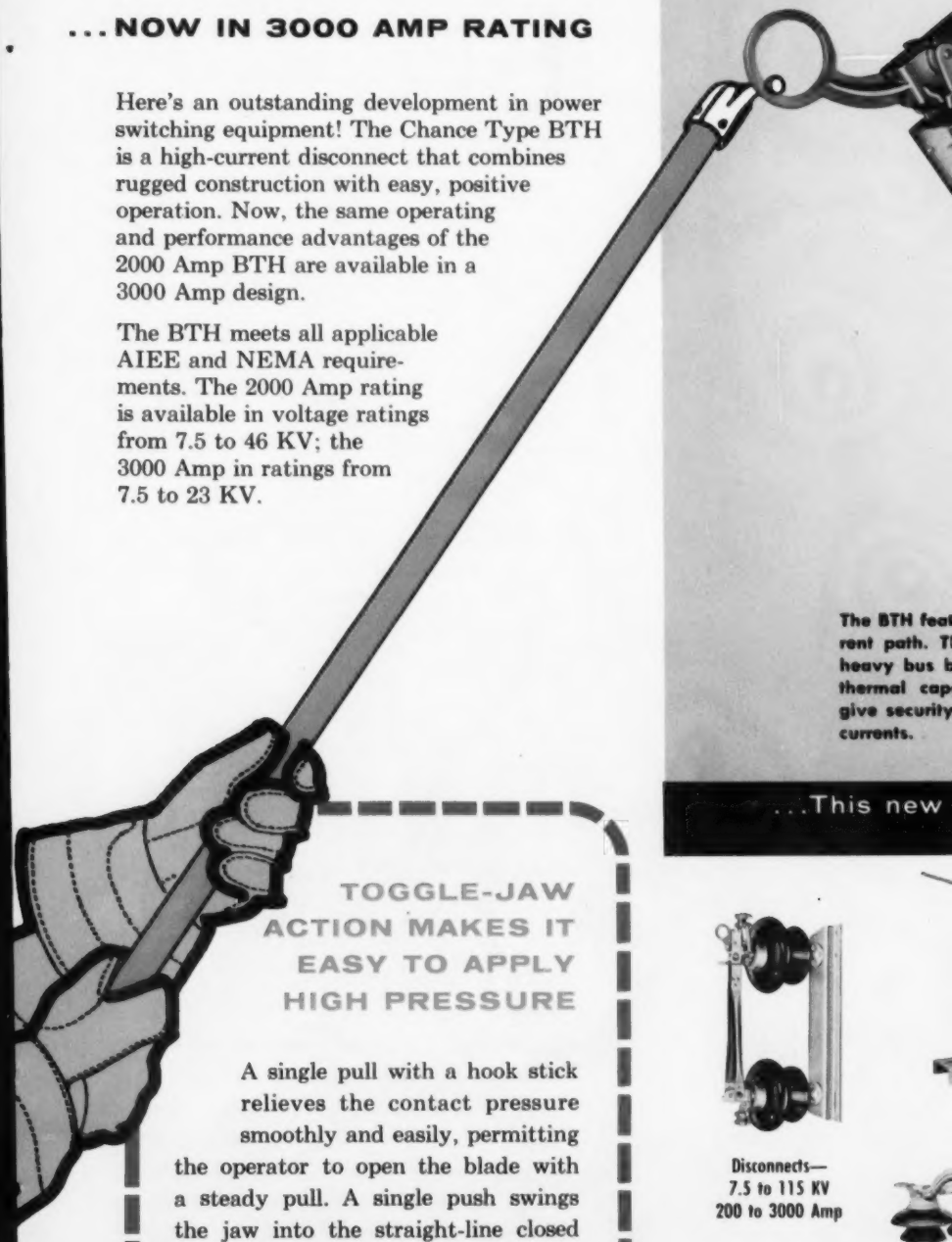
A. B. CHANCE CO.

CHANCE BTH HIGH-CAPACITY DISCONNECTS

...NOW IN 3000 AMP RATING

Here's an outstanding development in power switching equipment! The Chance Type BTH is a high-current disconnect that combines rugged construction with easy, positive operation. Now, the same operating and performance advantages of the 2000 Amp BTH are available in a 3000 Amp design.

The BTH meets all applicable AIEE and NEMA requirements. The 2000 Amp rating is available in voltage ratings from 7.5 to 46 KV; the 3000 Amp in ratings from 7.5 to 23 KV.



The BTH feat
rent path. T
heavy bus b
thermal cap
give security
currents.

...This new

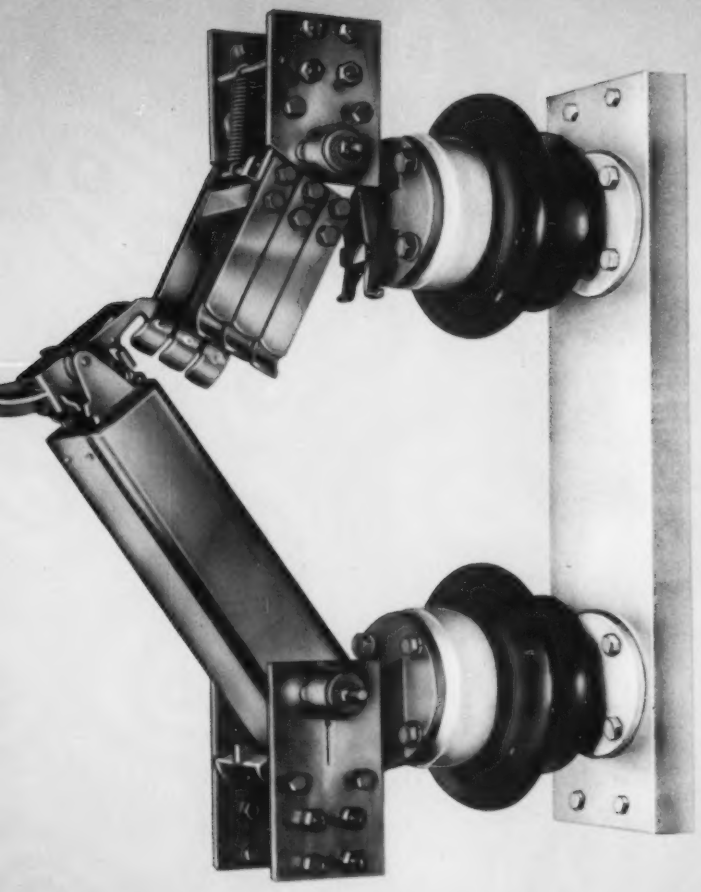
TOGGLE-JAW ACTION MAKES IT EASY TO APPLY HIGH PRESSURE

A single pull with a hook stick relieves the contact pressure smoothly and easily, permitting the operator to open the blade with a steady pull. A single push swings the jaw into the straight-line closed position, gradually applying higher pressure to the blade as it closes.

Disconnects—
7.5 to 115 KV
200 to 3000 Amp

Vertical Break—7.5 to 230 KV
400 to 2000 Amp

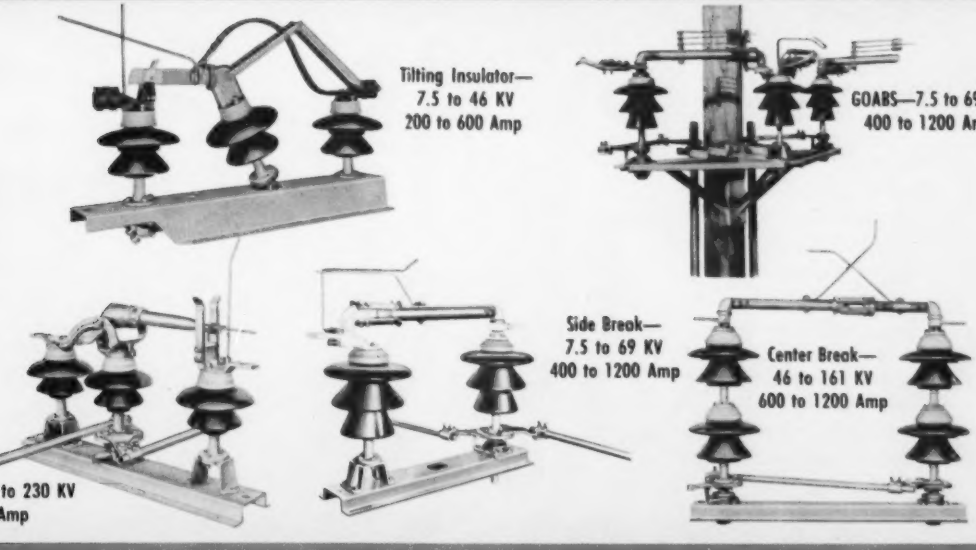
... you get
for 200 An



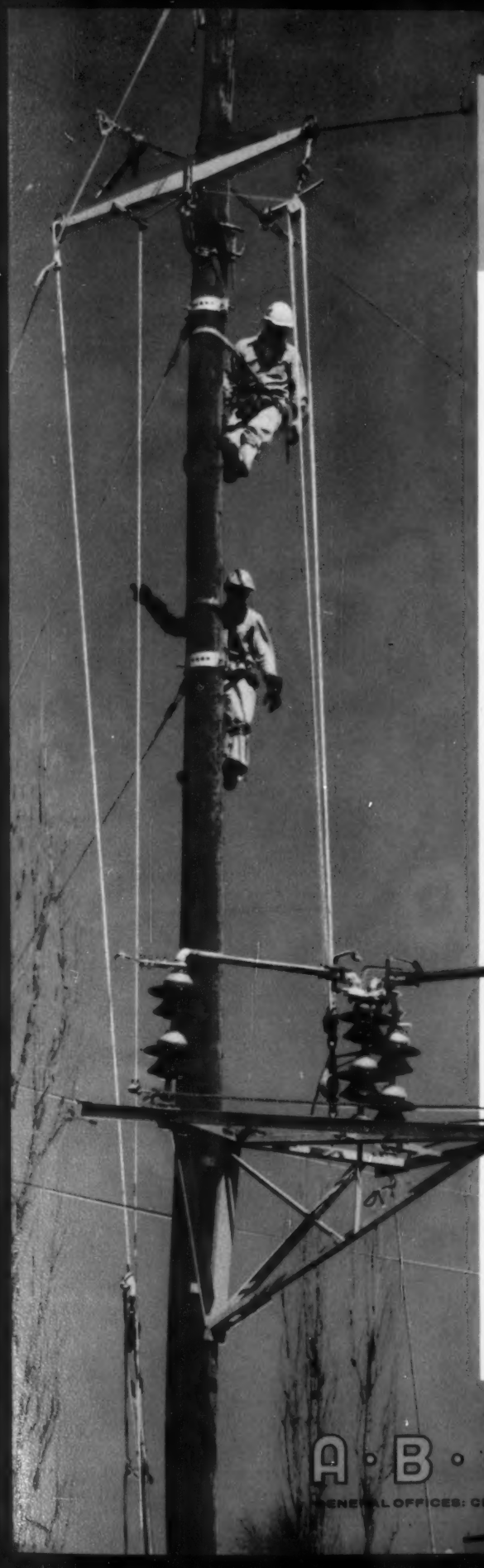
e BTH features a simple, straight-through cur-
nt path. The rigid square hollow blade and
avy bus bar copper construction provide the
rmal capacity and mechanical strength to
e security against damage from heavy fault
rents.

BTH Switches have *high pressure* contacts—copper to silver buttons. Toggle action of jaw automatically applies high pressure with minimum operating effort. Double blade latch holds switch firmly in closed position, releases easily with a pull of the hook stick.

s new switch is typical of the advanced switching equipment you get from the Chance line...



you get the finest in engineering design wheather your requirements are
200 Amp disconnects or complete substation switching arrangements.



Cut tap switching costs by installing

CHANCE Type "GS" GOABS

You're dollars ahead from the start when you put Chance Type "GS" GOABS on the pole. GOABS are Group Operated Air Break Switches designed for vertical phase-above-phase mounting.

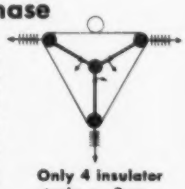
Only one pole for 1, 2 or 3 way switching

Single pole phase-above-phase mounting means lower initial costs, lower maintenance costs, and minimum right of way requirements.

Fewer Insulators per phase

Only 3 insulator stacks on 2-way

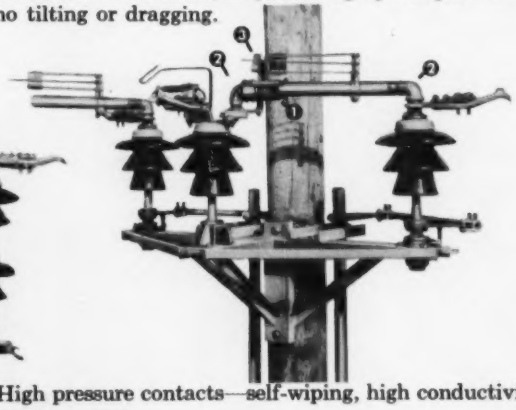
The "GS" design eliminates one insulator stack on each 2-way unit and two insulator stacks on each 3-way unit to provide up to 30% less weight.



Only 4 insulator stacks on 3-way

Speedy cost-cutting installation

GOABS are pre-assembled for maximum convenience in handling and installing. All-welded frames are completely assembled in all ratings. Assembling time is saved. Units are balanced for smooth, easy hoisting up the pole. There is no tilting or dragging.



1. High pressure contacts—self-wiping, high conductivity, silver to copper.

2. Braidless Construction—completely enclosed sealed silver-to-silver hinge contacts.

3. High-Speed Snap-Out Arcing Horns—to break magnetizing and charging currents.

Full NEMA *Rated*—7.5 to 69 KV, 400-600-1200 Amps, 1-Way, 2-Way and 3-Way.

CS58-14

A·B·CHANCE CO·

GENERAL OFFICES: CENTRALIA, MO. (A.B. Chance Co. of Canada, Ltd., Toronto)

A·B·C INDUSTRIES

McGuire Elected President of Duke Power Co

William B. McGuire (shown right) has been elected president of Duke Power Co effective January 1, 1959. He will succeed Norman A. Cocke who is retiring.

McGuire, 48, has served as a director of the power company since 1954 and as assistant to the president since 1956.

A graduate of Duke University Law School, he joined Duke Power in 1933 as assistant general counsel. He was a member of the company's legal department until his appointment as assistant to the president.

Cocke is retiring after more than 50 years with the utility. He joined Duke Power in 1906 as an attorney and became president in 1953.

He is responsible for conceiving and directing Duke Power's extensive forestry and land management along the Catawba River valley. He is vice chairman of the Board of Trustees of the Duke Endowment and has served on the Board of Directors of Duke Power and the Piedmont & Northern Railway since 1927. A director of Edison Electric Institute, he is also the first and immediate past president of Carolinas Virginia Nuclear Power Associates, Inc.

Foster Wheeler Names Pricher VP

Lawrence S. Pricher has been elected vice president-finance of Foster Wheeler Corp.

In this position he will be in charge of all fiscal and financial affairs of the corporation.

Pricher joined Foster Wheeler in 1946 as an accountant. Since then he has served as assistant controller, controller and chief financial officer.

Before joining Foster Wheeler, he served in the Marine Corps for 3½ years and on the controller's staff of Federal Shipbuilding & Dry Dock Co, a subsidiary of U. S. Steel Corp.

He is a member of the Controllers Institute, a financial counsel for the Machine & Allied Products Institute and is on the taxation committee of the National Association of Manufacturers.

Foote Given Plaque by AIEE

The American Institute of Electrical Engineers has presented a plaque to J. H. Foote, president and chief engineer of Commonwealth Associates, Inc., Jackson, Mich., in recognition of his outstanding services as a vice president of the Institute during 1956-58.

Foote was cited for his interest and devotion to his responsibilities in AIEE and to his profession. In performing his duties, he travelled over 18,000 miles, met with more than 35 sections and subsections, and visited over 25 student branches.

Iowa Public Service Names Corporon to New Post

E. K. Corporon has joined Iowa Public Service Co as assistant to the president. He was formerly president of the Interchange Power Services, Inc., which has been dissolved.

Corporon started his utility career with Kansas Gas & Electric Co in 1930. He was transferred to Phoenix Engineering Corp, and later returned to KG&E. In 1948 he joined the United Light & Railway Service Co when the United Power Pool was organized. When Interchange succeeded to the operation of the United Power Pool, Corporon was made vice president-secretary.

PERSONAL BRIEFS

American Society of Safety Engineers has elected **Michael F. Biancardi,** who is manager of the safety service section of Allis-Chalmers Mfg Co, treasurer.

Joseph T. Ryerson & Son, Inc, has appointed **C. Nelson Wetherell** manager of its Systems and Procedures Division.

General Electric Co has announced these recent changes: **J. C. Morris** to manager, coated materials and irradiated products operation for Schenectady and Pittsfield; **J. T. Rossello** to manager, mica products operation for Schenectady and Coschocton, Ohio.

Dr Ingo Ingenohl has joined Middle West Service Co as director of phychological services. He comes from the School of Industrial Management at the Massachusetts Institute of Technology, where he was assistant professor of industrial management.

These two companies retired the following: **William J. Olson,** Seattle City Light power-operations engineer who retired November 1, and **LeRoy O. MacLeod** who retired October 31 as advertising manager of the New York State Electric & Gas Corp.

Carolina Power & Light Co has assigned two new home service representatives to its Raleigh area —**Mrs. Hilda M. Jennings** and **Miss Glenda Noble.**

DANGER! CORROSION AT WORK...
IN CORROSIVE AREAS, WE USE ROZONE-ROSEAL POWER CABLE. THAT ROSEAL JACKET IS TOPS AGAINST OIL, CORROSIVE FUMES, AND MOST CHEMICALS
1
LOOK, MACK ... JUST ABOUT THE EASIEST- PULLING JACKET YOU CAN GET. BENDS EASY, TOO... EVEN AT BELOW ZERO TEMPERATURES
3
WET, HOT AND MUGGY! BUT ROME'S ROSEAL JACKET CAN TAKE IT! YESSIR, WHEN WE NEED DEPENDABLE POWER IN CORROSIVE ATMOSPHERES, WE SAY ROME'S ROZONE-ROSEAL POWER CABLE
USE ROZONE-ROSEAL POWER CABLE
REFINERIES
PAPER MILLS
STEEL MILLS
WHEREVER CORROSIVE CONDITIONS EXIST
4

William H. Speacht has been named general foreman of the Wilkes-Barre district of the Pennsylvania Power & Light Co. Previously he held a similar position in the company's Lanford District.

Wisconsin Electric Power Co has made these recent promotions: **Robert J. Powers** has been made assistant superintendent of electrical construction. He is being replaced in his former position of chief station design engineer in the Electric Distribution Division by **Nicholas A. Ricci. John B. Prince, Jr,** will take the position of electrical system engineer succeeding Ricci.

Washington Water Power Co has made these organizational changes: **J. Harry Lucas,** assistant vice-president, will open a Seattle contact office, for WWP. **Victor S. Casebolt** will become manager of the personnel and industrial relations department. **George M. Whitely** will become Palouse Division manager. Moving up to division manager post is **Virgil Thompson. Rich Bakes** has been named district manager in the mining area of Wallace. **Dave Johnson** has become storekeeper in the purchasing, stores and general services department.

Otter Tail Power Co has made **Ford Cole** general sales manager.

Electrical Associates has made these recent changes: **Carroll L. O'Shea,** General Electric Co, was elected president; **Edward R. Yonkers,** Graybar Electric Co, first vice-president; **William W. Stecker,** Consolidated Edison Co of New York, second vice-president; **Joseph B. Maguire** of John Doris, third vice-president; **Victor W. Rinhard,** treasurer; and **Andrew Jochum,** secretary.

The American Institute of Electrical Engineers has raised the following members to the grade of Fellow: **Ernest A. Johnson,** vice-president in charge of engineering, Southern New England Telephone Co; **Corbett McLean,** supervisor, Engineering Division, Pacific Power & Light Co; and **David E. Trucksess,** power development engineer, Bell Telephone Laboratories, Inc.

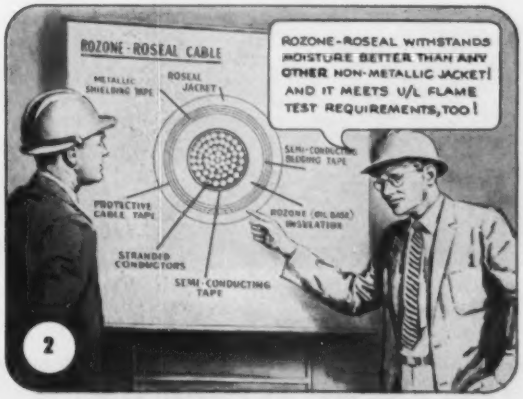
OBITUARY

Joseph A. Gallagher, 60, director of publicity for Public Service Electric & Gas Co died on Nov. 1 just before the start of the Navy-Notre Dame football game.

Clay Kauffman, 72, died recently in Lexington, Ky. He was a member of the Public Service Commisison for seven years.

Wilson J. Hauser, 91, who built and owned the White Haven (Pennsylvania) Power Co, died recently.

Fred R. Shedd, 59, executive vice-president and general manager of the Ohio Valley Electric Corp, died after a heart attack.



Available in voltage ranges through 15 kv Rozone-Roseal preferred power cable may be installed in air, conduit, underground ducts, or directly in earth. Your choice of premium ozone-resistant insulations: Rozone (oil-base) or Rozone A (butyl-base). For complete information, contact your nearest Rome Cable representative and ask for Bulletin RCD-700. Or mail the coupon today.

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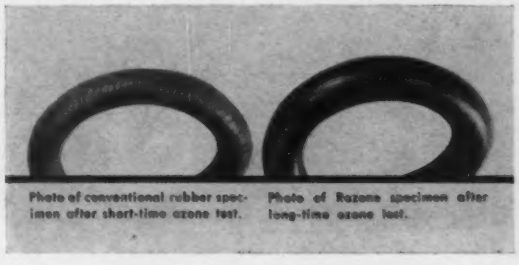

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FREE BULLETIN describes the benefits of Rome's preferred high-voltage power cables.

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Yesterday it was only a dream...

Today Westinghouse brings you an *all-purpose* cutout (**Type EU**) — *one* box and door to handle *all* your enclosed fuse cutout applications! No need to sleep in the warehouse, trying to keep up with the stocking needs for your system with four different boxes and twelve doors to match!

Think of the savings! Just one style box and door for all voltages — 2.6, 5.2, 7.8 kv — all currents up to 100 amperes continuous — with maximum interrupting capacities up to 14,000 amperes. The same cutout for dropout or non-dropout operation. It means simplified purchasing, smaller repair stocks . . . far easier maintenance.

No wild-eyed dream, this! We *know* Westinghouse universal cutouts will interrupt rated faults . . . over and over again. Beginning with carefully developed theoretical designs, we thoroughly proved their performance in grueling "controlled-fault" interruption tests at the Westinghouse High Power Lab. This is your assurance of full value for your protection investment.

A real value it is, too! Call your Westinghouse Sales Engineer today for complete details about this fabulous new cutout and its equally fabulous price. Or, write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-60966

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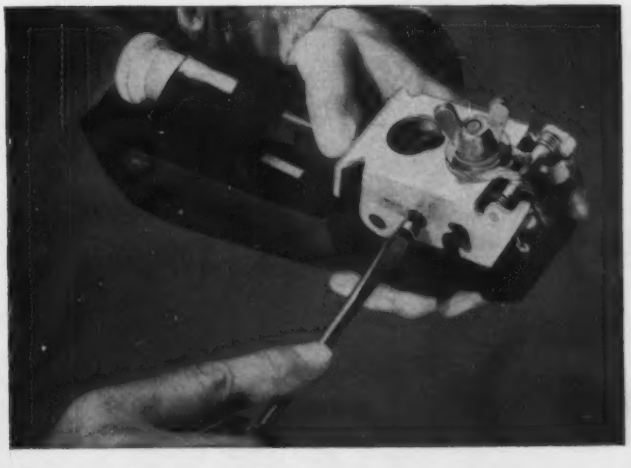

Dropout or non-dropout with a twist of the wrist

By simply removing one screw, the new Westinghouse EU universal cutout can be converted from non-dropout to drop-out operation. The Moldarta* door is designed for easy manual closing or hook stick insertions.

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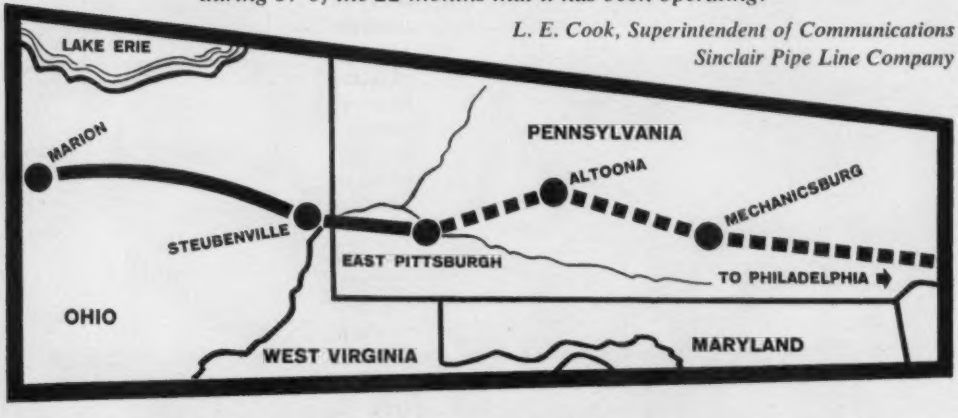
WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

Kellogg Microwave performs at 99.998% reliability!

"...this system has performed exceptionally well...100% continuity during 17 of the 22 months that it has been operating."

L. E. Cook, Superintendent of Communications
Sinclair Pipe Line Company



Only five outages in the 22 months of service this Kellogg PTM Microwave System has been in operation for Sinclair Pipe Line Company, and only two of these totalling 2 hours and 51 minutes caused by the microwave equipment. That's 99.998% reliability, far superior to physical circuits!

Sinclair's dual path system was inaugurated on October 13, 1956. The present system stretches 200 miles from Marion, Ohio, to East Pittsburgh, Pennsylvania. It features 8 channels, 2 terminal stations, and 7 repeaters. All intermediate stations have drop equipment. At East Pittsburgh, circuits are joined by similar Kellogg 10C PTM systems extending eastward to Mechanicsburg then to Philadelphia.

Sinclair's dual path operation between East Pittsburgh and Marion, Ohio has many advantages over conventional systems, principally the elimination of all switch-over equipments or circuits. A failure of one of the units will not interrupt traffic, hence there is no traffic time loss as a result of switching to standby. There is increased reliability since both operating units are continuously monitored for condition of operation. Space or frequency diversity equipments may be operated with a minimum of additional components. In addition to this high degree of reliability and continuous performance, Sinclair reports that "the signal-to-noise measurements have exceeded the original calculations and the system has provided excellent performance since the inaugural date of operation."

The Kellogg Model 10C-2 PTM Microwave System now features up to 45 channel multiplexing equipments. Channels are readily arranged to suit the needs of specific installation whether for telemetering, remote control, data and voice transmission. Our engineering staff is always at your service ready to discuss your communication problems.

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Why Kellogg PTM Is Setting New Performance Standards:

Microwave has made huge strides since first pioneered by International Telephone and Telegraph Corporation in 1931. Here are 10 reasons why Kellogg's Pulse-Time Modulation Microwave, perfected by ITT research, is inherently superior.

1 Easy maintenance, particularly of the RF equipment; visual test and check methods may be used.

2 Tubes may be changed at random *without* realigning the Intermediate Frequency Amplifier.

3 Where propagation is a problem due to multi-path cancellation, it is simple to install space diversity reception equipment.

4 Drop channels may be installed at random, without need to demodulate entire groups to audio.

5 Economical system design: drop and insert channels may extend only throughout those parts of the system where required, and not the entire length.

6 Maximum transmitter tube life; tube life averages approximately 15,000 hours for 2C39s.

7 All PTM channels are interchangeable, only one spare is required.

8 High signal-to-noise ratio: the inherent noise of each channel is "clipped" out. Each terminal and each repeater station transmits a fresh signal.

9 Less tower rigidity required for accurate signal transmission at 2000 mc.

10 Plug-in channel units feature printed circuitry replacing tubes with crystal diodes; demodulators semi-passive, one tube per channel; modulators passive, no tubes. Results in 4:1 reduction in the number of tubes and 5:1 reduction in power consumption.

Investigate these and other advantages of a Kellogg PTM Microwave system. Write for complete details.

Relay Changes

(Continued from page 80)

grounded-neutral transformer. Otherwise, zero-sequence voltage may be insufficient for positive relay operation on high-resistance faults. To simplify calculations for settings, the non-product type relay is used. It has dual polarization with both current and potential sources connected when available. Instantaneous trip elements are included when applicable.

Underground 120-kv cables in St. Petersburg, in connection with Plant Bartow, will have pilot-wire protection with reactance-type relays for back-up. Substations are protected with differential relaying on all major 115-kv and 69-kv buses and with overcurrent relays on less important 69-kv and lower-voltage buses.

Selection of a multi-circuit bus-differential relay was difficult due to factors other than reliability. Provisions for abnormal switching conditions, the number of circuits involved, etc, sometimes require more than one restraint-type relay per phase. Later additions to a bus having restraint-type protection may mean complete rewiring, and switchboard space may not be adequate.

The problem of how many circuits can be handled is eliminated with voltage-responsive differential relays. However, these relays require CT's with the same full-winding ratio. On new buses these CT's can be provided economically, but adding to older buses often results in dissimilar transformer ratios. Mismatched CT's have been corrected through use of good auxiliary CT's, the burdens of which are included in calculations for relay settings. As a result, voltage-type relays are used on most high-voltage buses.

Overcurrent relays are applied to medium and low-voltage buses when short-circuits are small enough to preclude CT saturation. Totalizing these line CT's through overcurrent relays affords adequate bus protection and protects distribution transformers connected to the bus.

In these overcurrent schemes, instantaneous-trip features are successfully employed to provide 5 to 8-cycle clearing, including breaker opening. Trip devices can be set

(Continued on page 146)

STEAM TURBINE PERFORMANCE AND ECONOMICS

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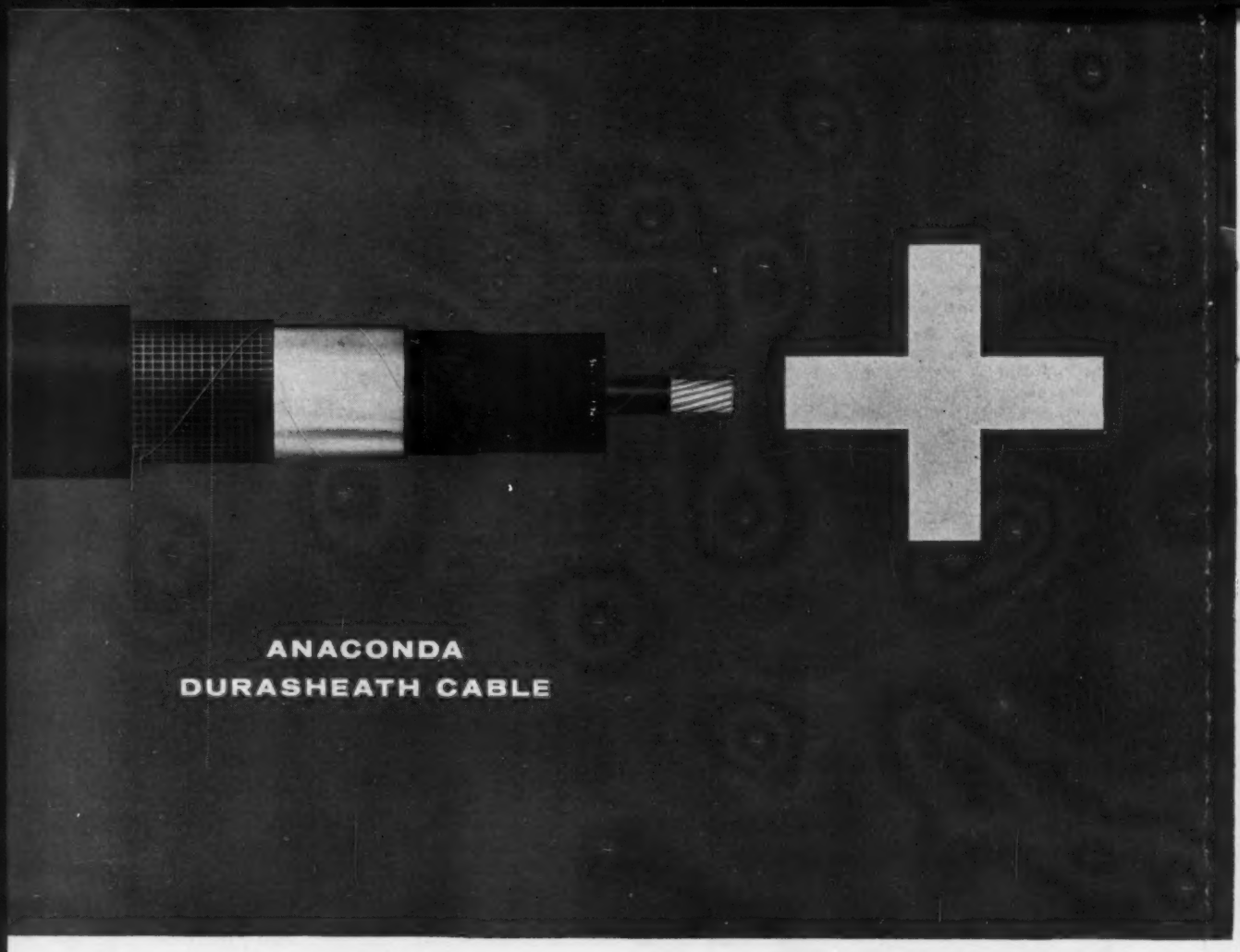

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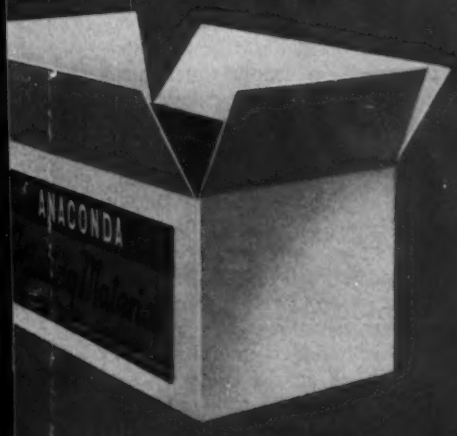

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SEE THE MAN FROM **ANACONDA®**
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Relay Changes

(Continued from page 143)

to pick up at 200% or more of distribution-bank 12.4-kv fault and still protect the 69-kv bus. Induction element generally is set at 250% to 300% of bank rating with sufficient time-delay to coordinate with feeder breakers. The relatively high pick-up setting prevents false tripping upon cold-load inrush.

Transformer-bank protection consists of differential relaying and, in most cases, overcurrent relaying. Differential protection is accomplished with high-speed, harmonic-restraint, percentage-differential relays. Overcurrent protection is applied to all banks, except at generating stations, to serve as back-up. These relays are set for short circuits and not for transformer thermal protection.

Circuit-reclosing practices are different for transmission lines, subtransmission lines, buses, and distribution. For backbone transmission, high-speed reclosing is applied. Individual phase dead-line checking devices, consisting of fast telephone-type relays, are connected to capacitance taps on each line-side bushing of the breaker. The breaker is reclosed immediately after trip-out by a one-shot recloser through three under-voltage relays with contacts in series. This scheme results in simultaneous reclosing of both line terminals within 20 cycles, provided breakers were tripped simultaneously (Zone 1 operation of impedance relays).

For faults in the 15% section of the line beyond Zone 1, both terminal breakers are reclosed simultaneously in 50 cycles following initial tripping. The extra 30 cycles is required to clear end-of-line faults by Zone 2 of the impedance relays. If this reclosing attempt fails, or if the line is energized from only one terminal, delayed reclosing follows under-voltage or synchronism check operations. Delayed automatic reclosing is not provided at generating plants; rather, reclosing is left to the operator's discretion.

Subtransmission line reclosing practice provides for testing a dead line or reclosing to a hot line through synchronism check features. Dead-bus testing features are applied to major buses at unattended stations. A one-shot reclosing relay automatically selects between a preferred and an alternate power source. If the preferred circuit is dead after a bus trip-out, induction-type voltage relays effect a transfer to the alternate source. The relays will reset if normal voltage prevails on the bus for a definite time, thus assuring only one test for any case of trouble.

Rather unique reclosing practices are applied to the distribution system, which consists predominantly of 7.56/13.09-kv circuits and some 4.16 kv. These circuits have both phase and ground-fault protection. Reclosing relays, set for various times, block reclosure to permit close coordination with other protective devices on the feeder. Just before, or simultaneously with the first reclosure, the reclosing relay blocks all instantaneous trips and the ground relay.

Thus the breaker is blocked for 5 sec following the first reclosure, except for tripping by the phase-overcurrent induction elements. Chances of leaving a conductor on the ground energized are reduced to a practical minimum because the ground relay is only removed from service temporarily.

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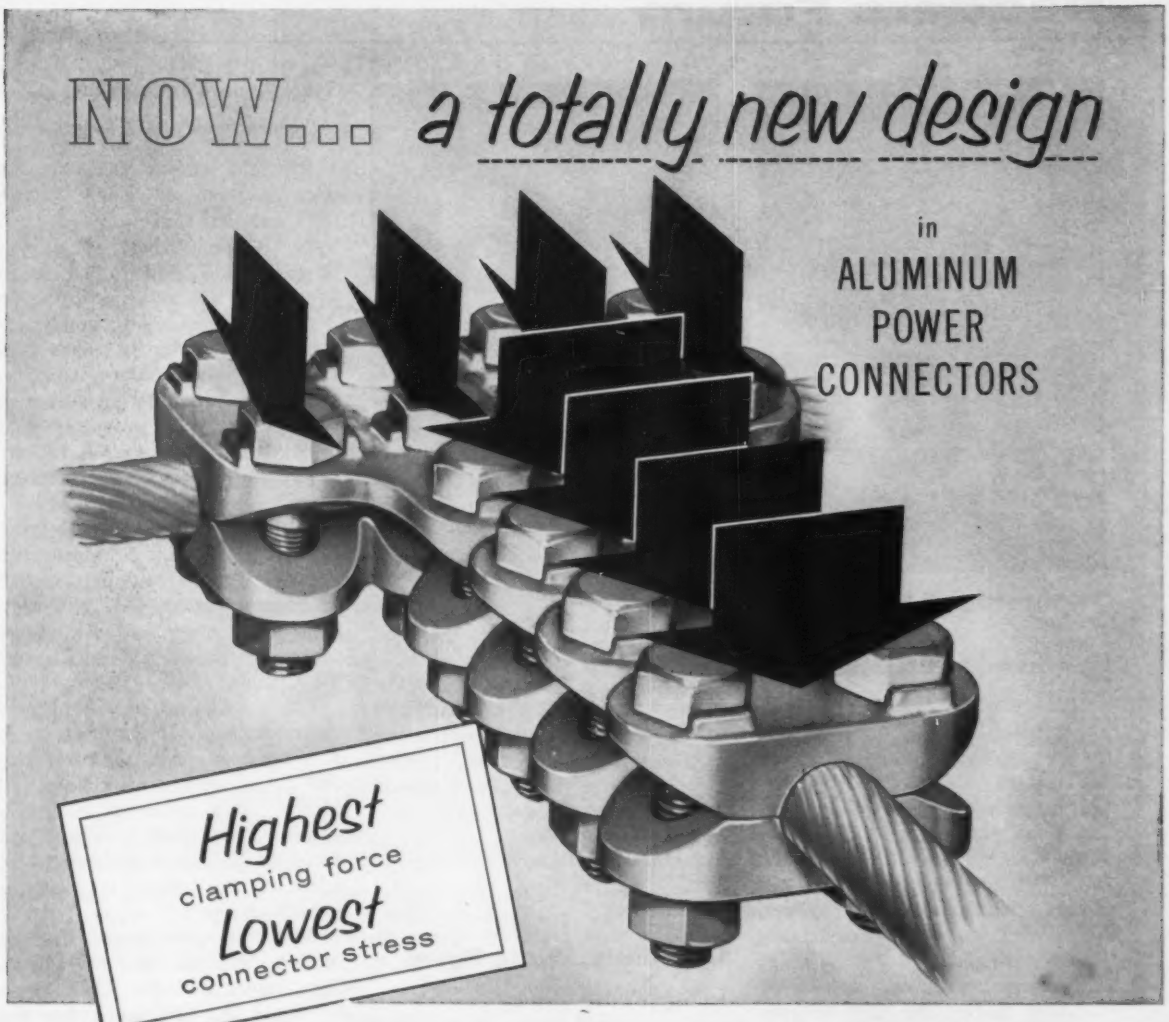

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Never one to play "follow the leader", Royal wasn't content just to create a line of connectors by changing the name and yet still use the bronze patterns . . . this had to be an *entirely* new connector. Sure it took longer to design, test and produce —many months longer—but here it is.

The *exclusive* HEAVY-SERIES BOLT CONFIGURATION in Royal's new bolted aluminum connectors means *highest* clamping force with *lowest* connector stress . . . greater strength and longer life. Nested bolt heads permit fast one-wrench installation.

Get all the facts in Royal's new Aluminum Connector Catalog #1. You'll see *148* different types, *7000* new items—and it's sectioned and tabbed for fast selection. A special section contains tables, charts and valuable engineering information . . . plus estimating and planning helps. Write Royal on your company letterhead today.

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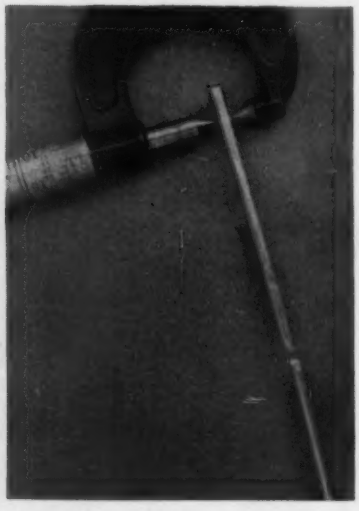
"Necking down" . . .



But outside chuck

Mechanical Splice Follows Wire Down

To the Editor:

Electrical World's August 4 issue carries a interesting report on the storm damage of March 20 in some Eastern states. However, it contains some guesswork on failures of mechanical splices. It says:

> "Two companies found failures of mechanical line splices, while two noted satisfactory performance of this type of splice. Trouble apparently was due to the wire necking down within the splice and then failing."

We have never seen and we have never been able to produce evidence of a wire stretching, or "necking down," or cold flowing within the chuck of a mechanical splice or deadend. If such reduction of diameter could occur, only the mechanical splice or deadend with its tapered chuck would stay with the wire, follow it down, and hold it.

There have been cases where the conductor pulled out of earlier design splices, but there have been no failures reported that concern splices made and properly used during the past nine years.

If there is sufficient load the line will draw down and break at its weakest point and it always breaks outside the gripping area. Our tests show the "necking down", but it does not take place until just before the characteristic cup and cone wire break. This is at least as likely to happen with a compression splice as with a mechanical one.

F. A. Leach
Reliable Electric Company
11333 Addison Street
Franklin Park, Illinois

Right Utility, Wrong Figure

To the Editor:

Several individuals have called my attention to the fact that Net Income data for the 12 months ended June 30, 1958 and June 30, 1957 for Monongahela Power Co should be for the 1958 period $6,137,972 and for the 1957 period $5,964,405 instead of $2,266,677 and $2,056,607 shown in your tabulation (EW, Oct. 6, pp 136, 137).

I also note you show for West Penn Power a footnote—"(a) All common shares owned by a holding company." You will find that minority interest common shares of West Penn Power are quoted daily over the counter market.

E. C. Summers,
Executive Vice President

Monongahela Power Co
Fairmont, W Va.

Figures shown for Monongahela were those for another utility. We regret the error.

Two Papers Involved

To the Editor:

I would like to correct an impression contained in the article of the Cigre, 1958 meeting by J. H. M. Sykes which appeared on page 40 of the July 7, issue of "Electrical World." The article implies that the work on spacers for bundle conductors is reported in Cigre paper 404. The motion picture which was presented at the Cigre meetings did cover the spacer program. None of this work, however, is reported in paper 404. Paper 58-779, "Horizontal Bundle Spacers" which I co-authored with R. J. Mather of Bonneville Power Administration, Portland, Oregon was presented by Mr. Mather at the AIEE Summer General Meeting and Air Transportation Conference, Buffalo, New York, June 22-27, 1958.

Paper 404 deals with general observations of vibration, on an indoor test span, an outdoor test span, and actual transmission lines. All of this work concerns itself with single rather than bundled conductors. A limited number of reprints of this paper is available, without charge.

While we are pleased that the publicity that has been given to the Cigre paper and the AIEE paper we would like to make it clear that two papers are involved.

A. R. Hard,
Head Vibration Research
Washington State Institute of Technology
Division of Industrial Research
State College of Washington
Pullman, Washington

N. Y. Sample Meter Tests

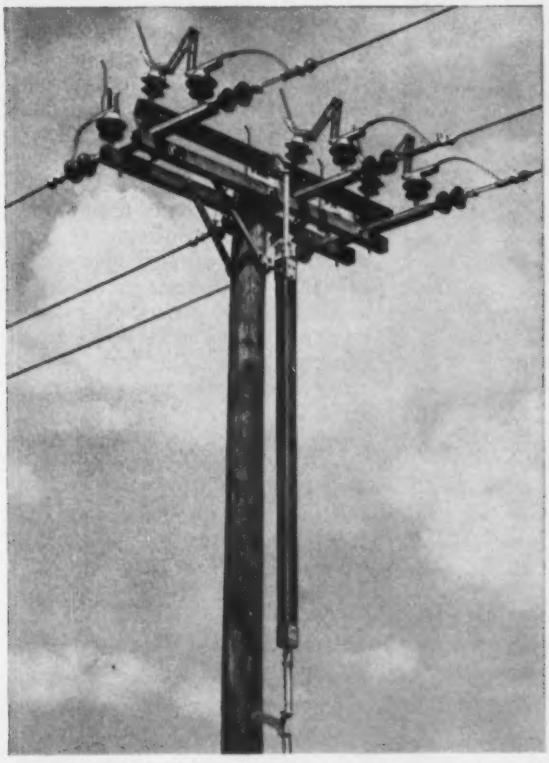
To the Editor:

Your reference to the revised method of the New York State Public Service Commission for scheduling electric meter tests is most interesting (Oct. 20, p 89).

However, it appears that one sentence may be misleading to those not familiar with the plan, to wit "But where meter performance indicates

(*Continued on page* 150)

R&IE TILTING INSULATOR SWITCHES



Easy to install R&IE Tilting Insulator Switches have steel channel bases designed for direct mounting on either substation structures or pole top crossarms. Available with manual, spring or motor-driven actuating device.

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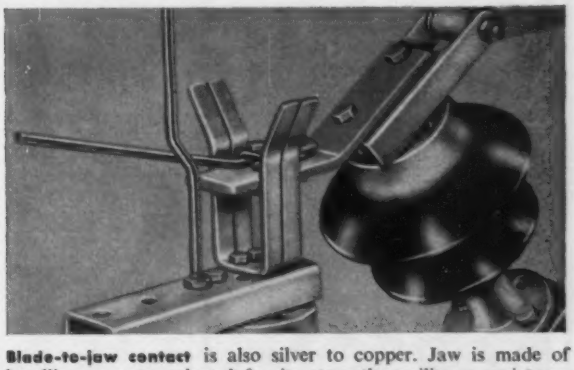

Blade-to-jaw contact is also silver to copper. Jaw is made of beryllium copper, selected for its strength, resilience, resistance to work hardening, and 600°C annealing point. Blade is hard-drawn copper, heavily silver-plated.

Shuntless, with silver-to-copper contacts throughout... for longer, maintenance-free service at no extra cost

In place of a corrosion-prone flexible braid shunt, R&IE Tilting Insulator Switches use a current carrying linkage, made of high conductivity copper, with silver-to-copper contacts at each of the hinge points. Silver to copper is also used between the heavily silver-plated switch blade and the beryllium copper jaw members. This construction—standard on all R&IE Tilting Insulator Switches—combines minimum resistance current transfer with maximum resistance to corrosion for longer, maintenance-free service at no extra cost.

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Wanted: Electric Distribution Engineer with college education and utility experience for a job open in a utility company in Southern Connecticut. Send complete resume of age, experience, and salary expected to P-9218, Electrical World.

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200	G.E.	2300	250/275
200	RDGWY	2300	250
150	AL-CH	2300	250/275
150	G.E.	440	250/275
150	WEST	2300/440	250/125
125	G.E.	4600	250
125	WEST	2300	250
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SEARCHLIGHT SECTION

(Continued from page 148)

a test requirement under 12.5% per year, the number of tests of that type need not exceed 200."

Actually the number of tests can exceed 200 when the meter population and rate of testing are sufficiently large. For example, assuming a population of 8,000 meters with testing required at the rate of 10%, 800 meters would be tested. However, if the rate of testing were 1.0% then a minimum of 200 meters would be tested since 1.0% of 8,000 is 80 meters and 12.5% would be 1,000 meters. The determination of the minimum number of meters to be tested is stated correctly in the note under the table on p. 89.

William Allen
Executive Secretary
State of New York
Public Service Commission
199 Church Street
New York 7, New York

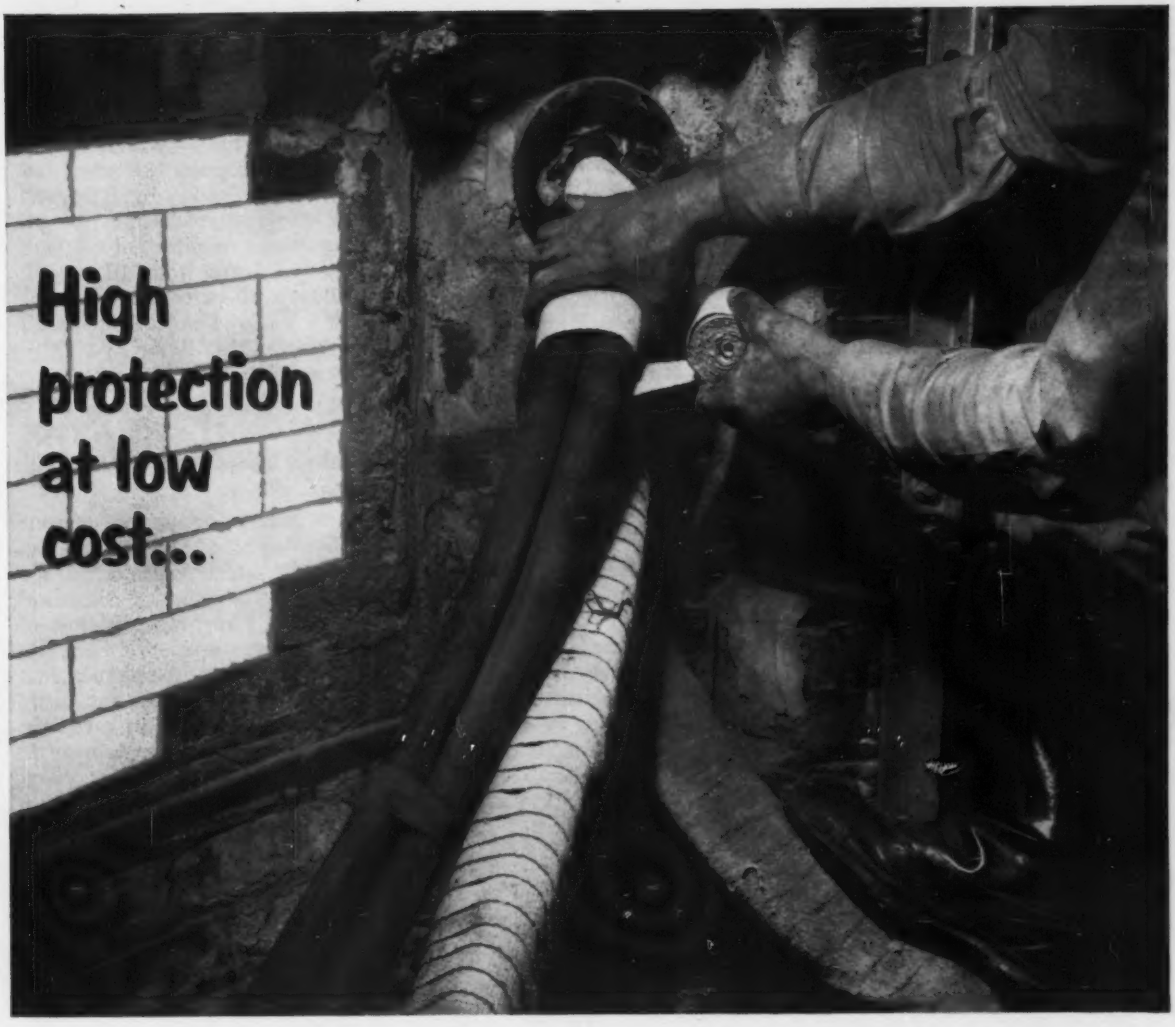
To the Editor:

I read with interest the article "Sample Testing Spurs Meter Modernization" in the Oct. 20 Electrical World. I was especially interested in the comments about the new meter-testing regulations of this Commission, permitting sampling for test purposes, inasmuch as I held the public hearings on the proposed changes, and reported thereon to the Commission, after conferences of representatives of the Commission's staff and of the companies involved in the hearings.

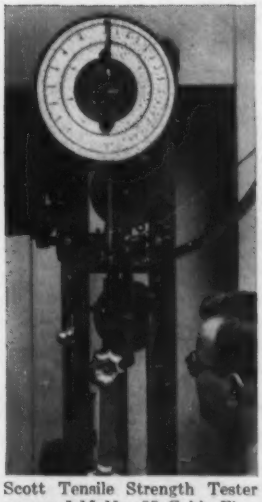
The short table accompanying the article gives a good idea of how this new permissive plan works. One important point that might have been stressed is that this plan segregates meters by types.

I am impelled to call attention to an error . . . reading "But where meter performance indicates a test requirement under 12.5% for a given type, in a year, and a resultant sample of less than 200 meters, the number of tests must be 12.5% of the meters of that type, or 200 meters, whichever is less". This, it will be noted, represents a safeguard rather than the extreme relaxation indicated by the other statement.

(Continued on page 152)



J-M No. 55 Cable Fireproofing Tape helps contain blowouts—isolate trouble



Scott Tensile Strength Tester proves J-M No. 55 Cable Fireproofing Tape maintains its high strength even after burnout.

Reduce the danger of arc multiplying your troubles in the event of cable failure. Repeated tests prove Johns-Manville No. 55 Tape helps contain arc and splash . . . and retains substantial strength even after being burnt out!

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JM PRODUCTS

Readers Forum

(*Continued from page* 150)

The corrected statement would apply to any group of 1,600 meters or less, of a given type and for a given company, inasmuch as 12.5% of 1,600 is 200. It would also apply to larger groups when the indicated test ratio is under 12.5% and results in a sample of less than 200 meters. If the test ratio indicates a sample larger than 200, such larger sample must be tested.

The footnote to the table might well be made more complete, as follows: "When test sample indicated is below 12.5% **and is less than 200 meters,** the minimum number to test shall be 12.5% or 200 meters, whichever is less."

H. M. Olmsted
Hearing Examiner
State of New York
Public Service Commission
199 Church Street
New York 7, New York

Utility engineers seek to provide metering of satisfactory accuracy with the smallest practical testing program. Where a commission ruling rewards high sustained accuracy with permission to cut back on periodic testing, they have added incentive to modernize metering plant. In this picture, the possibility of getting down to 200 tests per year on a high accurate type of meter holds real interest. This is what we read in the ruling, and still do for a population of 100,000 meter with 0.5% testing over 2% slow and none fast.

Co-op Financed by TVA

To the Editor:

On page 50 your May 26 issue states that "The Tennessee Valley Authority was established in 1933 and the following year the Alcorn County Electric Power Association, with no federal financing, began supplying TVA-generated power to customers over nearly 100 miles of line in and around Corinth, Miss."

Actually the Alcorn County Electric Power Association was financed from its beginning by federal funds lent by the TVA, and its rural lines were designed, built, and financed for the cooperative by TVA. This marked the inception of the program of federal promotion of rural electrification by means of assistance in organizing electric cooperatives, designing low-cost rural lines, and lending funds to build rural lines. Within a few years this program was given nationwide application by REA and was primarily responsible for increasing the number of nation's electrified farms from 10 percent to today's 96 percent.

Kenneth B. Metcalf
190 North Crest Road
Chattanooga, Tenn.

Abolish Speeches?

To the Editor:

I wish to voice approval of your editorial "Should We Abolish Speeches" which appeared in the September 8 issue of Electrical World. As I approach the close of a long engineering career, I become more and more of the opinion that most luncheon speeches and many of our convention papers have little to offer and actually bore many of the audience. Perhaps one paper in twenty presents a new idea or inspires reflection.

R. A. Monroe
Chief Design Engineer
Tennessee Valley Authority
Knoxville, Tennessee

Advertising Index

Air Preheater Corp. 33
Allis-Chalmers Mfg. Co. 8, 9, 37, 64
American Brass Co. 36
American Chain & Cable Co., Inc.
Page Fence Ass'n. 112
American Cresoting Corp. 117
Anaconda Wire & Cable Co. 144, 145

Babcock & Wilcox Co. 108, 109
Baltimore Ohio Railroad 57
Blackburn Corp., Jasper 17
Blaw-Knox Co. 13
Bristol Company 28
Brown Boveri Corp. 6

Chance Co., A. B. 133, 134, 135, 136
Colorado Fuel & Iron Corp.
Wickwire Spencer Steel Div. 107
Combustion Engineering, Inc. 10, 11
Commercial Filters Corp. 102
Continental-Diamond Fibre,
Sub. Budd Co. 49
Cornell-Dubilier Electric Corp. 100, 101

Delta-Star Electric Division,
H. K. Porter Company, Inc. 113
Directory of Engineers 146
duPont de Nemours & Co., (Inc.)
Elastomer Chemicals Dept. 56

Electric Service Works, Delta-Star Electric Division, H. K. Porter Company, Inc. 113
Engineers, Directory of 146
Enjay Company, Inc. 99

Federal Pacific Electric Co. 18

G&W Electric Specialty Co. 123
General Electric Co.
Apparatus Dept. ..... 2nd Cover
85, 86, 87, 89, 90, 91 92, 93
Graybar Electric Co., Inc. 7
Guaranty Trust Company of New York 121
Gulf Oil Corporation 50, 51
Gulton Industries, Inc. 110

I-T-E Circuit Breaker Co.,
R&IE Equipment Div. 149
Switchgear Div. 54

Johns-Manville 151

Kaiser Aluminum & Chemical Sales, Inc. 32
Kaiser Engineers Div.,
Henry J. Kaiser Co. 39
Kellogg Switchboard & Supply Co. 142
143
Kuhlman Electric Co. 38, 39

Lapp Insulator Co., Inc. 14, 15
Line Material Industries 23, 24, 25, 26

Macallen Co. 103
Moloney Electric Co. ..... 4th Cover
Motorola Inc. 40
McGraw-Hill Book Co. 143

Ohio Brass Co. 29, 30, 31
Okonite Co. 4
Orangeburg Mfg. Co., Inc. 41

Page Fence Ass'n
American Chain & Cable Co., Inc. 112
Pennsylvania Transformer Div.,
McGraw-Edison Co. 105, 106
Preformed Line Products Co. 62, 63
Premax Products Div.,
Chisholm-Ryder Co., Inc. 120

RT&E Corp. 96, 97
Radio Corp. of America 35
Reliable Electric Co. ..... 3rd Cover
Revere Copper & Brass, Inc. 27
Reynolds Metals Co. 124, 125
Roebling's Sons Corp., John A. 42
Rome Cable Corp. 138, 139
Royal Electric Mfg. Co., Inc. 147

S&C Electric Co. 118, 119
Sangamo Electric Co. 43, 44, 45, 46
47, 48
Searchlight Section 150
Sel-Rex Corp. 112
Shaw-Perkins Mfg. Co. 120
Simplex Wire & Cable Co. 12
Southern States Equipment Corp. 116
Southwire Company 55
Square D Company 61

United States Rubber Co. 16
Uptegraff Mfg. Co., R. E. 52, 53

Victor Insulators Div.
I-T-E Circuit Breaker Co. 93
Wagner Electric Corp. 58, 59
Western Red & Northern White Cedar Association 111
Westinghouse Electric Corp. 34, 114, 115
127, 128, 140, 141

PROFESSIONAL SERVICES 146

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EMPLOYMENT OPPORTUNITIES 150

EQUIPMENT
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For Sale 150

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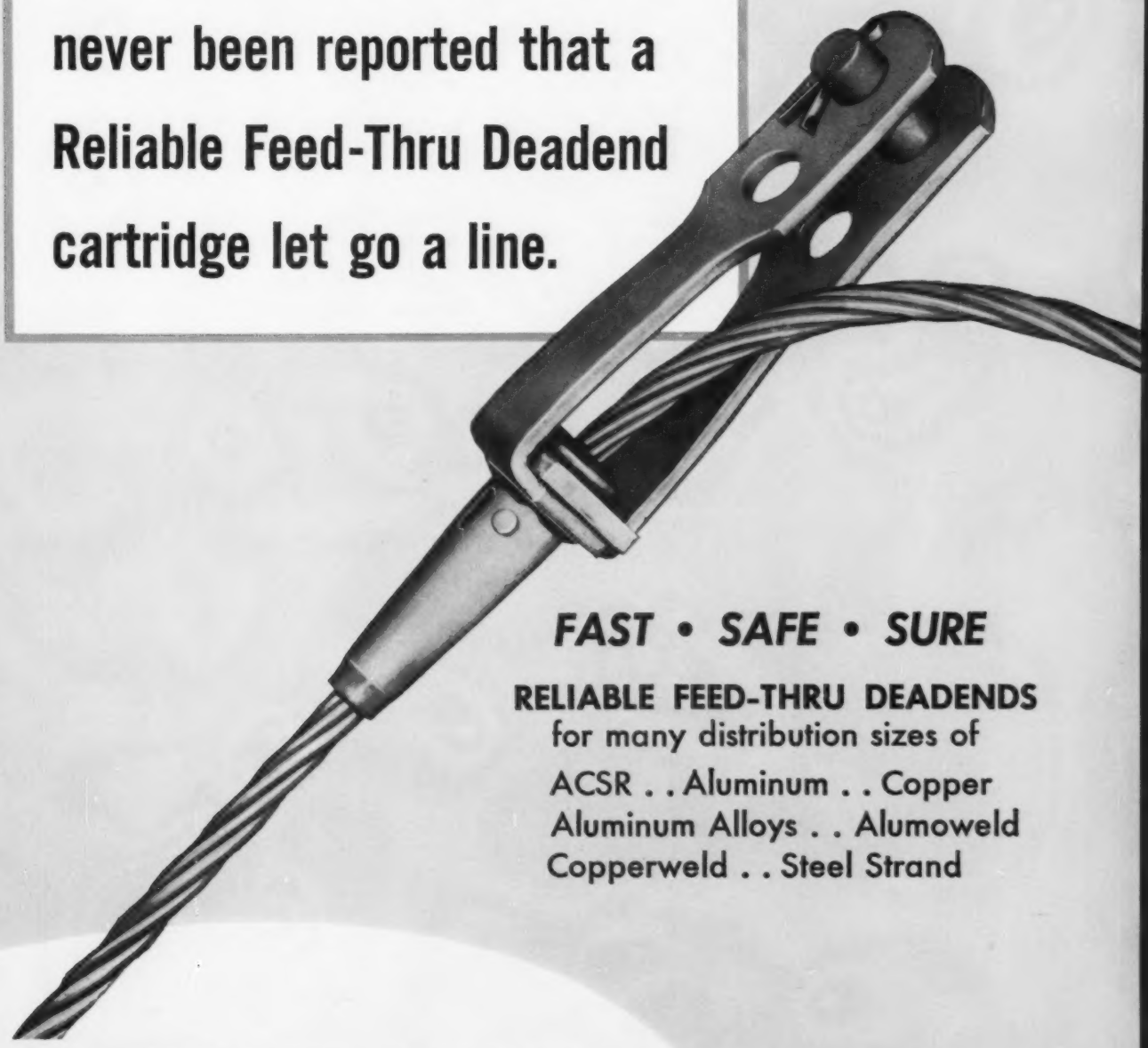

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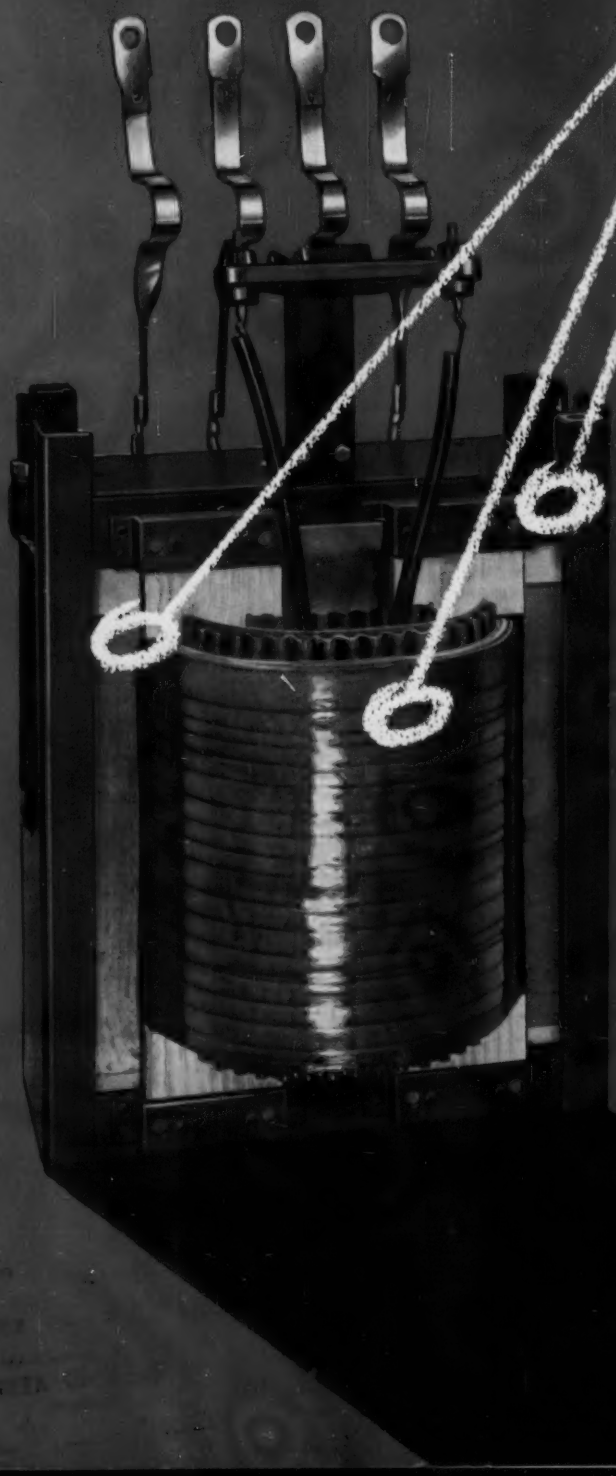

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